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WORLD PETROLEUM (including Petroleum Equipment Exporter) vol. 17, No. 4, April, 1946. Entered as Second Class Matter at the Post Office at Orange, Connecticut under the act of March 3, 1879. Published monthly August to June, semi-monthly in July, at Boston Post Road, Orange, Conn. by Mona Palmer Trustee under will of Russell Palmer, 2 West 45th Street, New York 19, N. Y. Subscription price $5.00 per year, single copies 50 cents each.

WORLD PETROLEUM

Founded by Russell Palmer

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

Rex W. Wadman
General Manager

E. W. Mayo
Editor

J. C. Chatfield
Managing Editor

Heyworth Campbell
Art Editor

SUBSCRIPTIONS

Annual subscription $5.00 (U. S.) postpaid.
Single copies 50 cents.

GENERAL OFFICES

2 West 45th Street, New York 19, N. Y.
(Tel. MUrray Hill 2-7333)

BRANCH OFFICES

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CHICAGO 1: W. R. Cotton, Mid-West Advertising Manager, 307 No. Michigan Ave., *(Tel. Franklin 2508)*

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World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer

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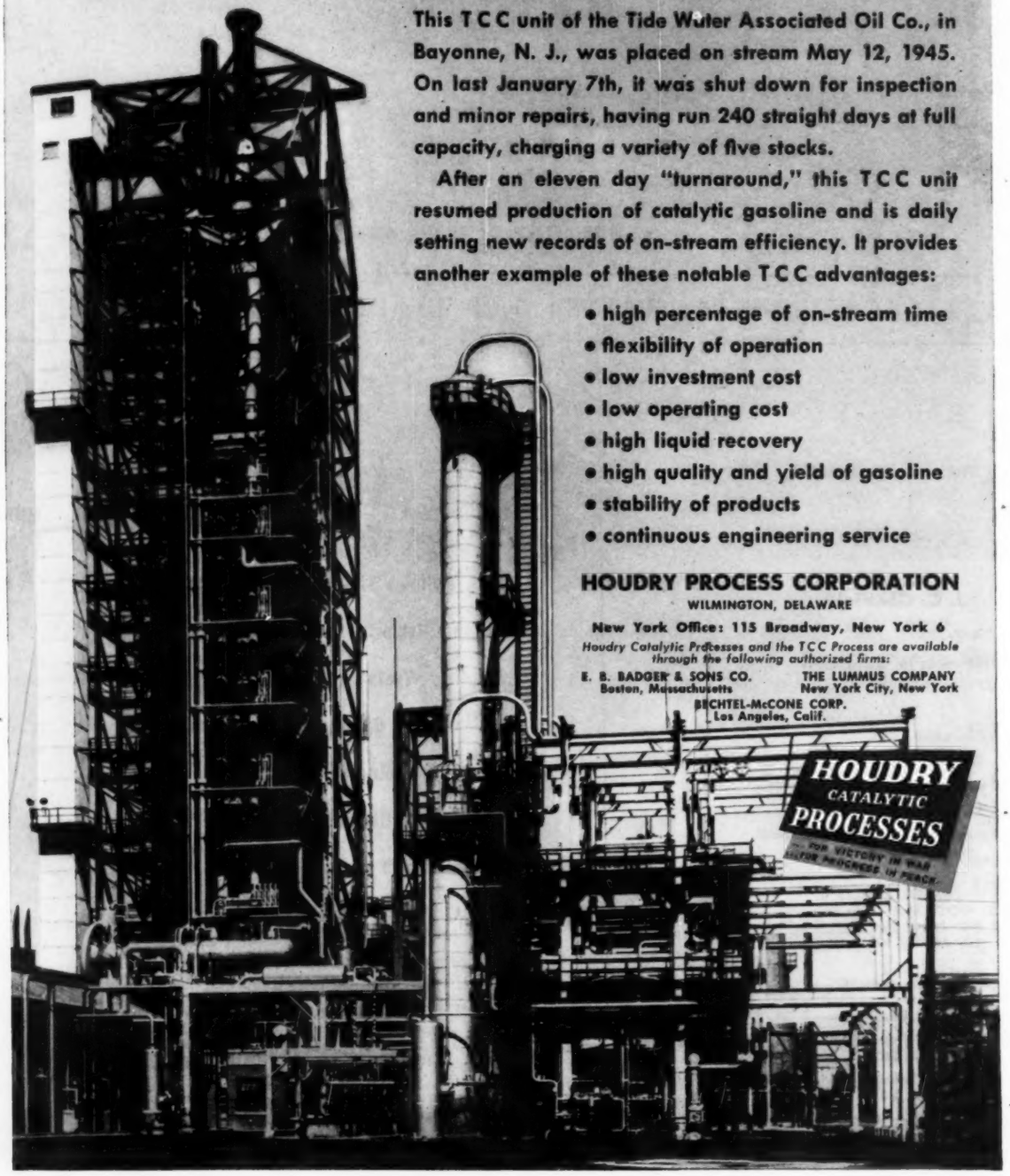
Front Cover: Manifold System at Baton Rouge Station of Plantation Pipe Line Co.
Photo by Corsini, Standard Oil Co. (N.J.)

INITIAL RUN 240 DAYS... BACK ON STREAM IN 11 DAYS!



This T C C unit of the Tide Water Associated Oil Co., in Bayonne, N. J., was placed on stream May 12, 1945. On last January 7th, it was shut down for inspection and minor repairs, having run 240 straight days at full capacity, charging a variety of five stocks.

After an eleven day "turnaround," this T C C unit resumed production of catalytic gasoline and is daily setting new records of on-stream efficiency. It provides another example of these notable T C C advantages:

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- **low operating cost**
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EDITORIAL

OPA POLICIES SLOW INDUSTRIAL RECOVERY

ONE of the remarkable achievements of American industry in 1945 was the speed with which the preliminary steps toward reconversion to peacetime operation were taken following the termination of the war. The lag in employment was far less than had been anticipated. In localities where the sudden closing of war plants terminated hundreds of thousands of jobs the workers were employed in the change-over or quickly absorbed in other lines of activity. Employers generally realized that wage readjustments were needed to meet changing conditions and many advances in hourly rates of pay were made voluntarily as a partial offset to the change in the working day or the loss of overtime that had fattened the pay envelopes of employes under the pressure of military demand. Industry generally was intent on getting the wheels turning to satisfy the need for all manner of goods in which acute shortages had developed.

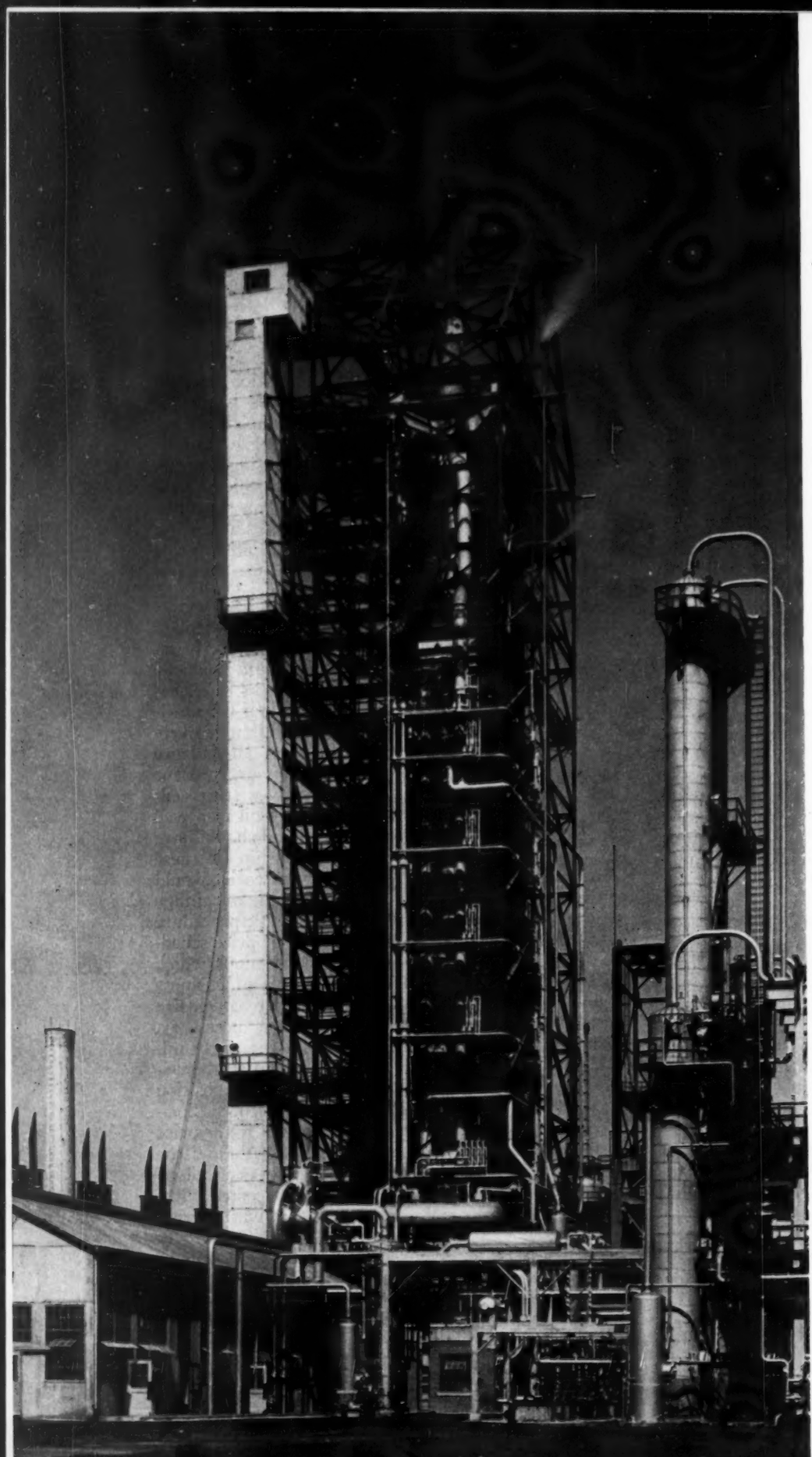
Instead of the mounting activity to which these early indications pointed we are confronted by industrial stagnation, business uncertainty and an alarming failure to supply the products to which the public is entitled. Confidence has been undermined as the country has been allowed to drift to an economic crisis.

Reconversion was greatly aided by the prompt action of the War Production Board and various other agencies in lifting the controls which had restricted the use of materials and the production of many kinds of commodities. It was helped also by the early settlement of outstanding war contracts. Had the same procedure been applied to price controls which were no longer necessary the bright promise afforded by the rapid readjustment of business to its normal function of supplying consumers' goods in full volume the country would now be in the midst of unprecedented activity, costly industrial disputes would have been avoided and the consuming public would be able to satisfy its most urgent needs instead of being forced to accept driblets of inferior and unsatisfactory goods. As is becoming increasingly clear the dictum laid down by OPA that its wartime system of price ceilings must be maintained until supply equals demand has been a primary factor in preventing the establishment of this equilibrium and in creating industrial stagnation and uncertainty.

In adherence to its slogan of "hold the line" OPA has endeavored to make it appear that the only cause of inflation is a rise in commodity prices which actually are a sympton of the malady not its well-spring. It is simple enough to be obvious that when the purchasing power of the community or a large segment of it is increased without increasing the supply of products by which it can be satisfied inflation is bound to result. One of its commonest causes is the increase of the money supply and the implements of credit which regularly takes place during a state of war and reduces the value of the purchasing medium in terms of commodities. In addition to freeing production energetic and if need be drastic steps should be taken to reduce governmental expenditures and bring them into balance with revenues. In spite of this evident relationship, no concerted effort has been put forth in official quarters to end deficit spending.

Illustrative of the thinking of OPA is the statement of its then chairman Chester Bowles before a Congressional committee in regard to petroleum products. Admitting the existence of gasoline stocks in excess of current needs the Price Administrator acknowledged that removal of the price ceiling might as likely be following by a market decline as by an advance but he added that it would result in a rise in kerosene and fuel oil prices and, therefore, that existing ceilings should be retained. The fact is, as oil men well know, that changed conditions in demand should have led to a change in the price relationship of these products, a change which naturally and easily would have taken place in a free economy to the advantage of the consuming public. The characteristic procedure of OPA has been to resist all revisions of price schedules, to delay as long as possible concessions which are shown to be essential to the conduct of business and to grant only partial relief where conclusive proof has been presented that relief is necessary. Where this course has been followed the slight advances permitted have been insufficient to start business moving while they have weakened the position of the Price Administration itself. Its recent authorization of an increase of ten cents a barrel in the price of crude oil is a case in point of "too little and too late." During the war control of prices as well as rationing and other regulations were accepted without question because it was realized that with a great part of the country's productive capacity devoted to satisfying military requirements it was impossible to supply the full normal needs of civilian consumption fed by the greatly swollen purchasing power of the public. In fields where similar conditions still exist there may be reason for continuing such supervision.

For the general run of commodities, however, the reason for maintaining the rigid wartime controls ended when peace returned and industry was prepared to take up the task of supplying civilian demands. Price control of manufactured products stands in the way of this logical and natural process. It should end now. After all, production is the one effective cure for inflation.



NOTABL E

On January 7, 1946, the Thermofor catalytic cracking unit No. 8 at the Tide Water Associated Oil Company's Bayonne, N. J. refinery was shut down for inspection after an initial run that began on May 12, 1945, thus establishing a record of 240 days of continuous operation.

Credit for this performance is ascribed by the refinery operators first to the excellence of the design of the equipment, secondly to the thorough training of the unit's crew and the care they exercised in working the controls, and thirdly to the faultless performance of the integral gas handling equipment which handled the gas produced; any fault in the operation of the gas equipment, on which the catalytic cracking unit is wholly dependent, would have interrupted the operation of the Thermofor unit.

This Thermofor unit No. 8 at the Tide Water refinery took the place of a pre-existing tube and tank thermal cracking unit. The conversion was effected by The Lummus Company, refinery construction engineers, in collaboration with Tide Water Associated engineers, Petroleum Engineering Company and the Houdry Process Corporation. It is the 27th TCC unit to be designed and erected by Lummus, and the 7th conversion job which this company has participated.

Throughout the initial run of 240 days the unit handled a charge to the reactor of more than 10,500 barrels a day; it considerably exceeded its guaranteed performance in charging rates, quality and yields of products, and circulated 100 tons of bead catalyst per hour.

Like other TCC units, this one consists of a reactor, and a regenerator; there is one bucket elevator for transferring catalyst from the base of the reactor to the top of the regenerator and another bucket elevator which transfers regenerated catalyst from the base of the regenerator to the top of the hopper above the catalyst reactor. (See diagram). There is thus continuous circulation of catalyst from reactor to regenerator and back again.

The height of the reactor vessel is 57 feet and a few inches; its internal diameter is 16 feet. The main features of its internal construction are a top drum or catalyst distributing section, a middle section which includes the effective catalyst bed and an empty space into which vapors may disengage, and a funnel shaped bottom section from which spent catalyst is continuously taken for regeneration. Experience has shown that the subsidiary arrangements within the reactor must be carefully proportioned, and the long initial run

← Thermofor Catalytic Cracking Unit No. 8, Bayonne Refinery, Tide Water Associated Oil Company

ERFORMANCE of a TCC UNIT

of this No. 8 unit indicates that its design has been highly successful.

In the operation of this unit the catalyst in the hopper above the reactor, which has a temperature of 825° to 900°F. from the regenerating operation, flows by gravity down the feed leg into the catalyst distribution section of the reactor. Arrangements for distribution consist of a dished plate across the reactor, from which feed pipes extend downward into the reaction section. It is necessary to keep the plate covered with catalyst at all times.

The middle reaction section of the reactor where catalytic cracking takes place contains the effective bed of catalyst, which is 35 feet deep and holes 7000 cubic feet of catalyst. Hot oil vapors from the vaporizing furnace enter the reactor below the bed of actively working catalyst through a vapor grid inlet. This inlet grid must be designed with the view to securing equal distribution of vapor across and through the catalyst bed. The ascending vapors move at a carefully controlled speed counter currently against the downward moving catalyst until they reach the free space beneath the concave catalyst distribution plate and make their exit from the reactor through judiciously placed outlets in this space. The pressure within the middle reaction section amounts to 10 to 12 psi. gauge while the catalyst hopper operates at ordinary atmospheric pressure. The pressure in the reaction section being the higher, a seal is required at the top of the vapor-disengaging space to prevent hydrocarbon vapors from entering the catalyst distribution section, the feed leg, and the catalyst hopper.

To make this seal, some oxygen-free flue gas is introduced into the reactor above the distribution plate through an automatic controller which maintains a constant and positive pressure differential between the catalyst distributing section and the vapor-disengaging space. Since the controller maintains a slightly higher pressure in the distribution section than in the vapor-distributing space there is a continuous slight flow of this flue gas from the distributing space into the vapor space. This keeps oil vapors out of the distribution section, and so the vapors are made to flow through the vapor outlets into the vapor line leading to the fractionator. At the same time there is a small but steady flow of flue gas up the feed leg countercurrent to the descending catalyst.

The funnel-shaped bottom section of the reactor contains several catalyst flow plates. The flow plates are equipped with downpipes distributed so that, in combination with the funnel-shaped bottom, the rate of flow of the catalyst is uniform throughout the entire cross section area of the reactor. The proper location of the holes in these plates is critical. Stripping steam is introduced between two of the reactor catalyst flow plates. This steam strip the spent catalyst substantially free of oil vapor and also forms a seal in the bottom of the reactor.

As in all catalytic cracking processes, a certain small fraction of the oil vapor is converted to carbon and deposited on the grains of catalyst. The catalyst then loses efficiency and so must be withdrawn and regenerated by burning off the carbon. The spent catalyst is drawn off from the bottom of the TCC reactor by a continuously operating "chopper" valve which controls the catalyst level in the hopper, and also the rate at which the catalyst is fed into and through the reactor.

After the catalyst has been released from the reactor by the chopper valve it passes by gravity down a slide line to a depressuring pot where a jet condenser ejects steam and other entrained gases. From here the catalyst flows, also by gravity to the foot of the kiln elevator which takes it to the top of the regenerator. This TCC regenerating kiln is about 135 feet high. The casing which surrounds the elevator forms a part of the whole closed system and is more practically gas tight. The kiln itself has to be designed with the same care as with the reactor to secure even distribution of the down-moving spent catalyst and maintenance of proper seals.

The operation of the elevators was watched closely as the elevators constitute an important part of the unit Constant cleaning of the foot shaft sliding seal plate pockets as well as continuous lubrication of the bearings and sprockets made it possible to run the elevators for over 240 days without a shutdown. The operation of the walking beams was checked many times a day as was the flow of cooling water through the shaft cooling glands.

The maintenance of proper seals on the top and

↓ Control Panel in Control Room

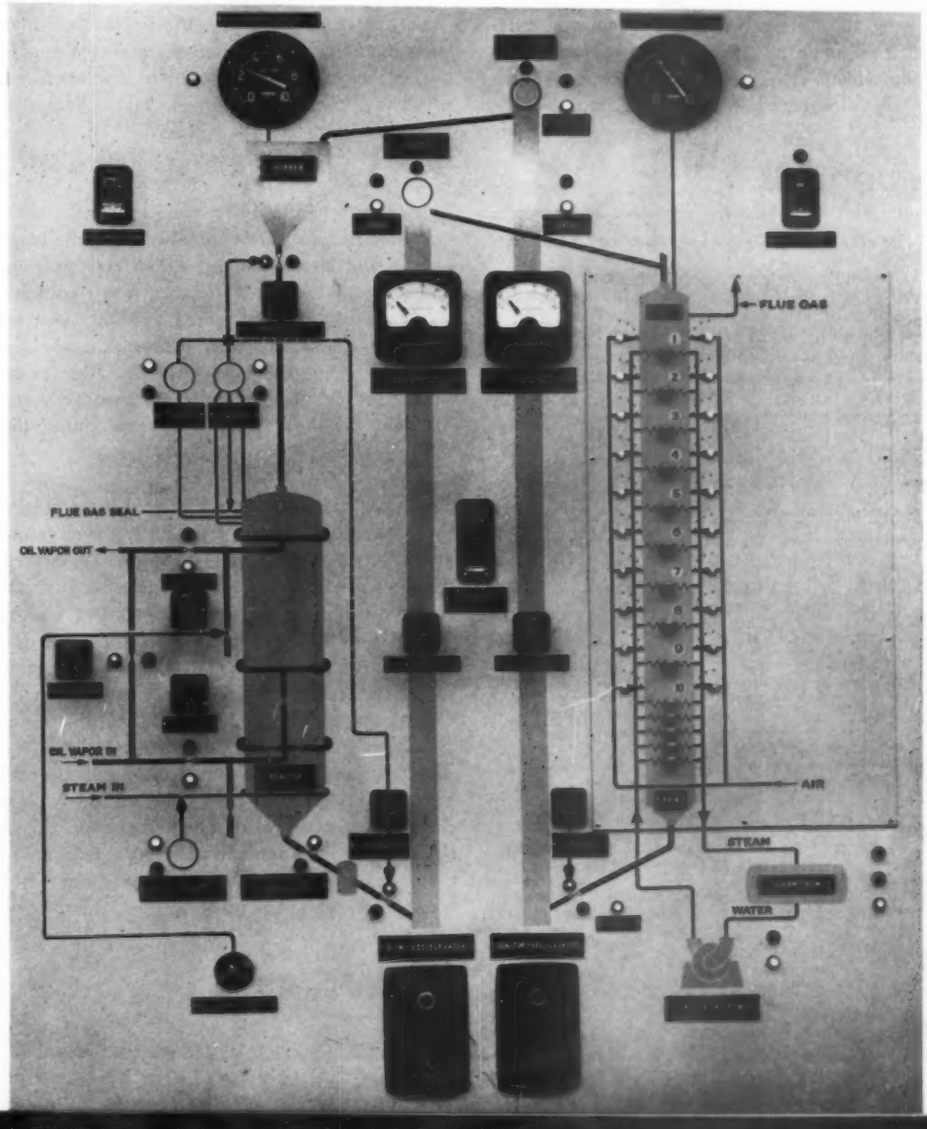


TABLE 1

CRACKING VIRGIN GAS OIL FOR MOTOR GASOLINE

(Non-Recycle)

Typical Day—September 9, 1945

	BPSD	Vol. % Fresh Reactor Chg.	°API	ASTM Distillation IPB	10%	50%	90%	E. P.	RVP	Color	PM Flash	SSF @ CFR-M 112°F. Clear
Charge												
Virgin Gas Oil	10,749		32.8	275	535	630	750	770			86	
Tar Separator Bottoms	663		27.5								200+	13
Total Reactor Charge	10,086	100.0	33.1	225	540	632	720	737			98	
Products												
9.6# Motor Gasoline	4,640	46.0	57.3	94	117	227	375		9.6	30		78.5
Light Gas Oil	3,423	34.0	31.6	465	524	546	582	598			200+	
Heavy Gas Oil	1,378	13.7	25.2	525	635	671	725	752			140	
C4 Fraction	1,036	10.3										
Dry Gas (C3 & Lighter)		≈4.7 Wt. %										

Summary of Operating Conditions

Reactor		*Reactor*		*Kiln*	
Catalyst Bed Depth	14′ 8″	Purge Steam	3,400 lbs/hr	Air to Kiln	950° F.
Space Velocity (total)	0.80 V/Hr/V	Reactor Inlet Pressure	10 PSIG	Steam Production	30,454 lbs/hr
Catalyst/Oil Ratio (total)	1.75 V/V	Oil to Reactor	930° F.	Maximum Kiln Temp.	1145° F.
Catalyst Activity	34 A.I.	Catalyst to Reactor	880° F.		
Steam with Charge	*10.600 lbs/hr	Average Reactor emp.	885° F.		

*Includes purge steam

bottom of the reactor was also important as the loss of the seals at these points could have resulted in shutdowns. These seals were watched carefully and as a result very few difficulties were experienced. The holding of a proper level in the reactor hopper is also quite important and this level was also watched continuously. In connection with the above, it was important to keep the differential, purge steam and catalyst level indicators in excellent working condition. The use of a flue gas sweeping system for the differential and pressure taps on the reactor also helped to keep these instruments in service.

From all points of view the unit has given a satisfactory performance. Its versatility was demonstrated soon after V-J Day when the unit was switched from 100 octane gasoline production to motor gasoline operation. For the first 100 days the charge to the unit was one-pass Houdry gasoline and this was processed for direct blending into 100 octane gasoline. The unit then switched abruptly to cracking heavy gas oil for the production of high quality motor gasoline. This changeover was accomplished in less than three hours, the operation continuing throughout the change. Results of that operation are illustrated in the accompanying table. Since that time the unit has charged crude oil, further demonstrating its flexibility.

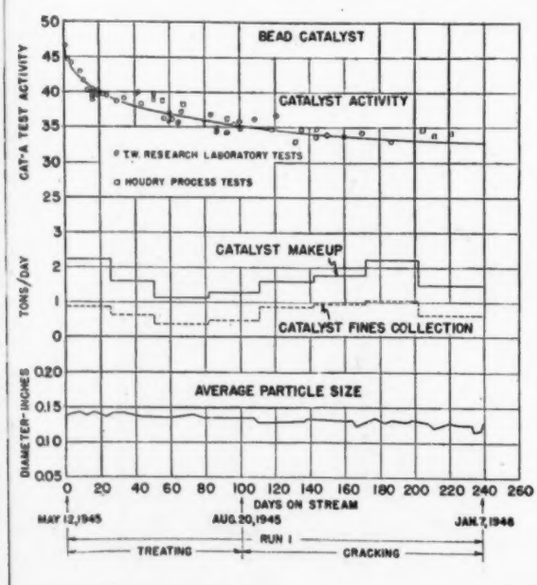
Since this was the unit's maiden run, actually two new records were established, viz., the longest run and also the longest initial run made on a TCC unit to date. Moreover, it is significant that the unit was not forced to shut down on January 7th. It had been planned to take the plant off stream one week prior but, due to an unexpected change in the refinery operations schedule, the shutdown was postponed until the date mentioned above.

Following the shut down, a careful inspection of the catalytic equipment, particularly the elevators and kiln, was conducted. This inspection showed the unit to be in excellent condition. In fact, within five days, the catalytic equipment was in readiness for catalyst circulation. However, due to minor difficulties with electrical equipment and to inclement weather conditions, resumption of operation was delayed until January 18th.

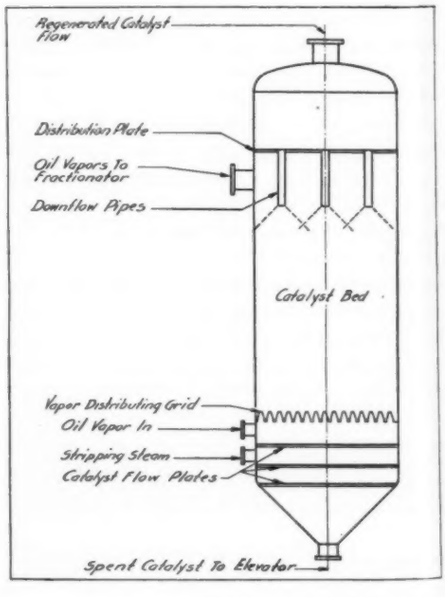
The eleven-day "turnaround" of the plant comprised an inspection of principal equipment items, the completion of minor mechanical repairs and the cleaning of miscellaneous items such as fractionators, coolers and heater tubes. Since little mechanical servicing was required, the down period was very short and the man-hour labor expenditure for repairs was significantly low. Table 2 shows a breakdown of the total man-hour requirement by job. The total working man-hours for the turnaround of the catalytic section was only 9,755; moreover, of this total some 2,000 hours were spent in opening and "buttoning up" the kiln on which practically no repair was required. Undoubtedly, the fine condition of the kiln may be attributed to the excellent control over regeneration conditions which the process provides. The rate of carbon removal in each burning zone is adjusted by air inlet damper settings and cooling coil usage to maintain all regeneration temperatures within desired limits.

Neither the reactor itself nor the catalyst hopper

↓ Chart of Catalyst Experience During Initial Run



↓ Thermofor Catalyst Reactor



were opened. The satisfactory operation of this vessel was considered a good indication of its sound mechanical condition. Work around the reactor consisted of inspection and cleaning of the auxiliary equipment, the resetting of four safety valves and some backwelding on superheated steam lines.

TABLE 2

Item Inspected	Actual Man-Hours	Percent of Total
Kiln	2,302	23.6
450# Boiler	95	1.0
Reactor	302	3.1
Reactor Hopper	122	1.3
Reactor Elevator	1,109	11.4
Kiln Elevator	1,745	17.9
Air Line Burner & Air Blower	72	0.7
Flue Gas Generator & Compressor	142	1.5
Depressuring Pot	192	2.0
A Heater	544	5.6
B Heater	529	5.4
Oil Vapor Superheater	119	1.2
Fractionating Tower	785	8.0
Instrumentation	1,155	11.8
Clean-Up Labor	177	1.8
Miscellaneous	365	3.7
GRAND TOTAL	9,755	100.0

Inspection of the kiln revealed the refractory insulation, steam cooling tubes and internal distributing elements to be in excellent condition. A few lateral flue gas collectors were slightly warped but not to such an extent that repair was necessary. Some repair of the kiln hopper internal insulation was required and slight erosion was noted on the "wear" plate of the chute from the kiln feed elevator to the kiln. The chute covers were lined with manganese steel and a subway grating was installed over the liner for the purpose of retaining a layer of catalyst over which the influent catalyst stream might flow.

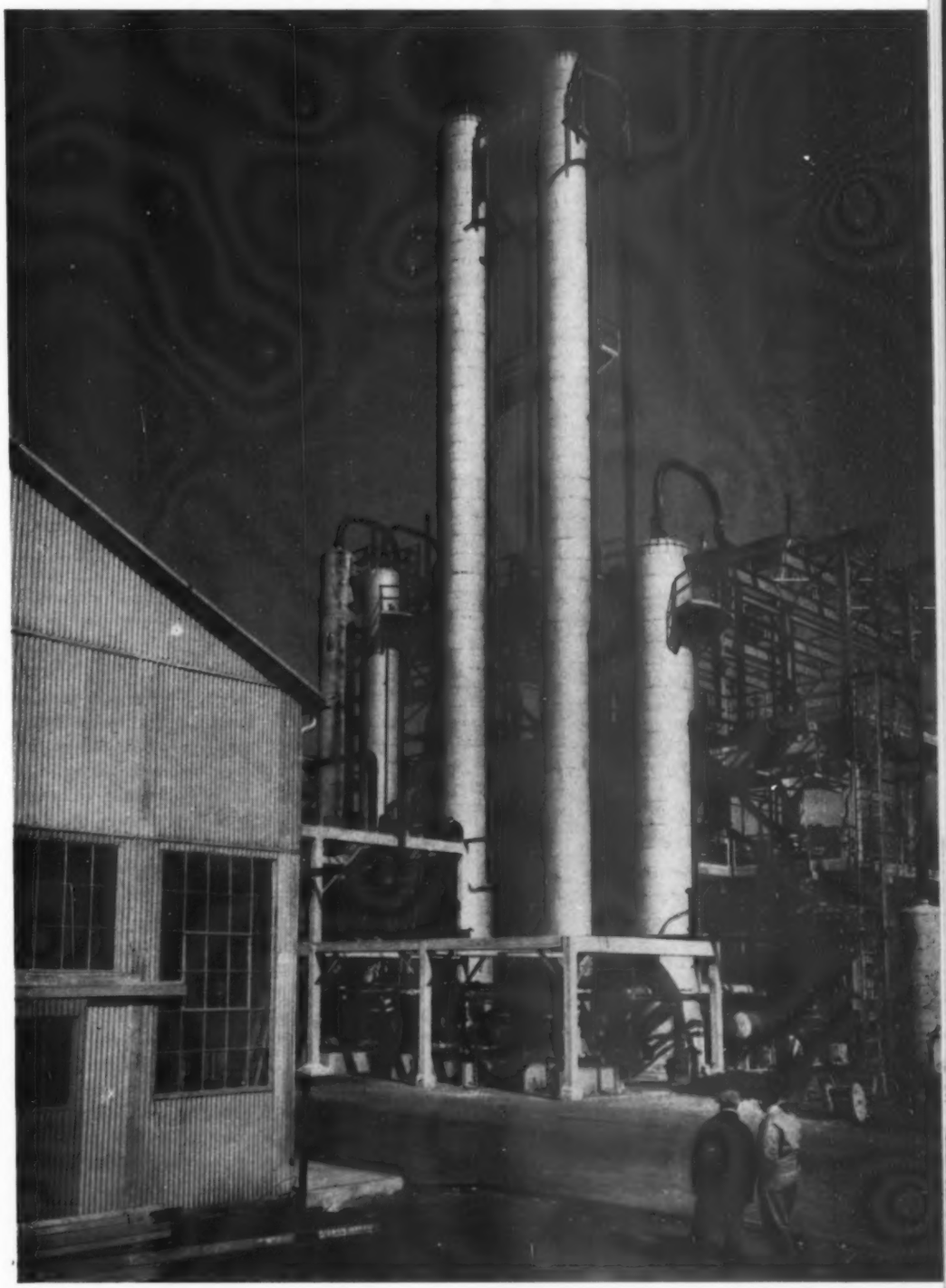
No repairs to the cooling coils were required; however, the 1¼ inch safety valves were inspected and reset. Other kiln work consisted principally of renewal of the asbestos cloth on the expansion joint in the catalyst inlet line, the installation of orifice plates in all cooling coil inlet lines and routine instrument maintenance.

A complete inspection of the catalyst elevators was conducted. For all practical purposes, the elevators had been in continuous operation for a total of 262 days. Normal wear was observed on the chain linages and sprocket wheels of both elevators. To correct for the resulting elongation, two pairs of chain links and two catalyst buckets were removed from each elevator. Also, the teeth of the upper sprocket wheels of each elevator were reversed in order to present new wearing surfaces and to obtain the maximum life from the sprockets.

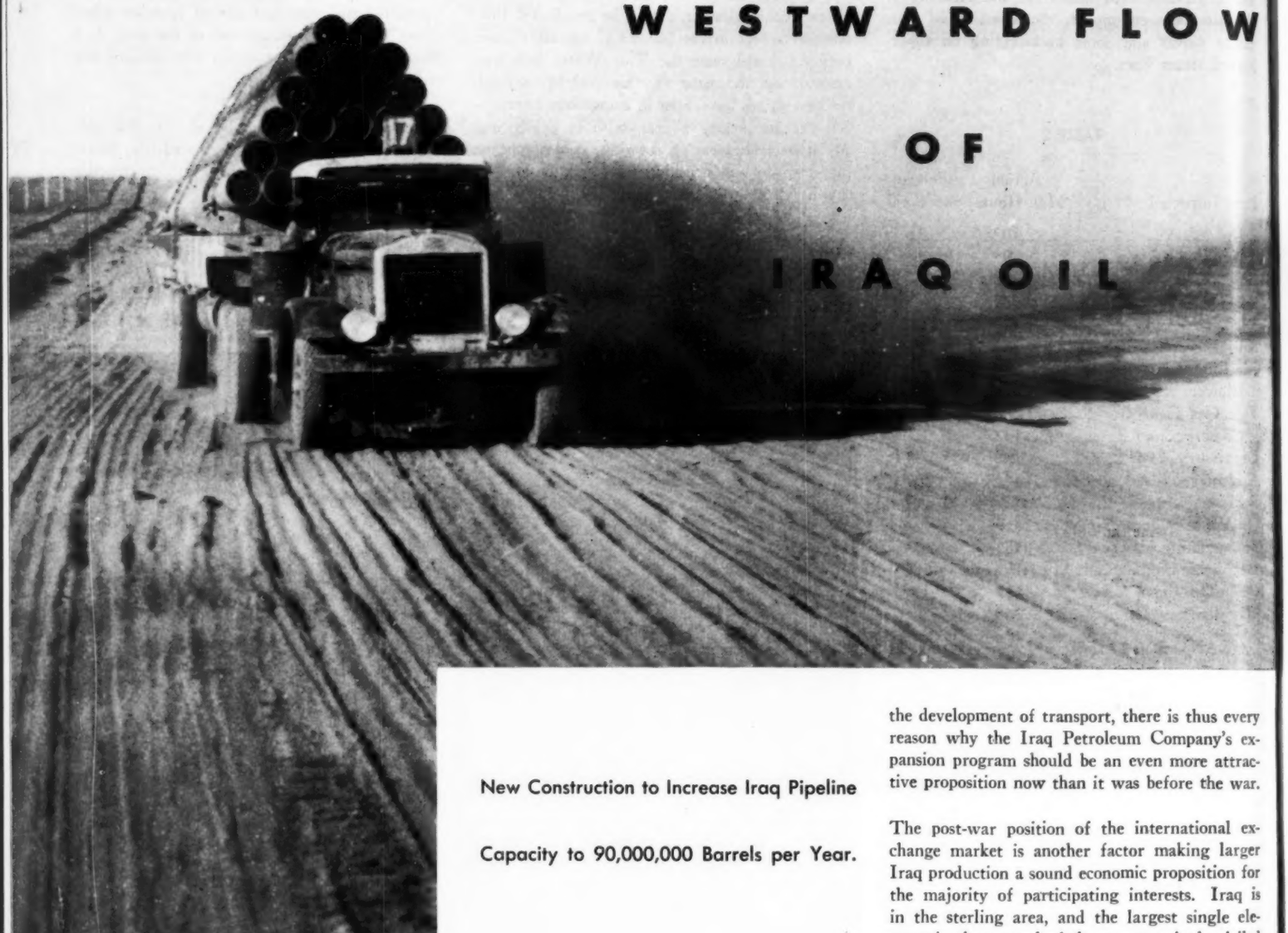
In this connection, it should be mentioned that traction wheel drives for TCC elevators have been developed since the Tide Water unit was erected. At the time of this writing, several traction drives have been in continuous commercial use for nearly a year without evidencing any appreciable wear on the rims. It also appears that less pin and brushing wear will be experienced. All new TCC projects will include traction rims as standard equipment. Although traction rims had been purchased and could have been installed, the Tide Water management considered that the past operation of the elevators warrented the continued use of sprocket wheel drives during the second run of the unit. It is planned to install the traction rims at some convenient time in the future.

It took teamwork to build and run this unit, and all the companies and personnel who played a role in the unit's development and construction are proud of its record.

↓ Gas Handling Equipment of the Thermofor Catalytic Cracking Unit No. 8.



TRIPLING WESTWARD FLOW OF IRAQ OIL



New Construction to Increase Iraq Pipeline Capacity to 90,000,000 Barrels per Year.

DUPLICATION of the pipeline over the 620 miles from the Kirkuk oilfield to the Palestine port of Haifa had already been planned by Iraq Petroleum Company before the outbreak of war in Europe in 1939. Subsequent economic events have strengthened the view of the controlling interests that oil delivered to Mediterranean ports from adjacent fields must be in a strong competitive position.

Russia has emerged from the war as a rapidly mechanising nation, with an almost insatiable need for petroleum. She seems definitely out of the market as an exporter and has already taken measures to divert Romanian production to herself, thereby cutting off another potential source of Mediterranean oil supplies. Aside from the great demand for petroleum products that must ultimately be set up by the war-time impetus to the development of transport, there is thus every reason why the Iraq Petroleum Company's expansion program should be an even more attractive proposition now than it was before the war.

The post-war position of the international exchange market is another factor making larger Iraq production a sound economic proposition for the majority of participating interests. Iraq is in the sterling area, and the largest single element in the control of the company is domiciled in Britain, with a large part of the remainder domiciled in Europe. Iraq Petroleum Company is owned as to 23¾ percent each by Anglo-Iranian and the Royal Dutch-Shell group. Similar percentages are held by Societe Francaise des Petroles and by Near East Development representing Standard of New Jersey and Socony-Vacuum, the remaining five percent being owned by C. S. Gulbenkian through Participations and Investments Limited. It is probably a safe conjecture that the majority of these interests in Iraq Petroleum would prefer paying for new oil developments at the present time in sterling, rather than in one of the world's "strong" currencies such as United States dollars.

Both economic and financial reasons, therefore, impel Iraq Petroleum to lose no time in taking up its war-interrupted plans for increasing oil deliveries to the Levantine coast. It has extended its original project to the duplication of the

pipeline to Tripoli, as well as that to Haifa, and has this time undertaken installation of 16-inch lines to both these terminals, compared with 12-inch and 10-inch pipe used in the existing lines, completed in 193-.

The present lines have a total rated capacity of 4,000,000 tons of crude a year, of which half is normally delivered through each leg. New construction with heavier pipe will add double the present capacity to each section, giving a total annual capacity of 12,000,000 tons or roundly 90,000,000 barrels. Based on actual performance of the existing lines, this will mean in practice the possibility of handling at least 13,000,000 tons annually. Contract for the pipe—the largest single order for steel pipe ever placed in Britain—was secured by Stewarts and Lloyds Ltd. The project will call for 180,000 tons of pipe and total material in excess of 250,000 tons.

Technical advances in pipeline construction and operation during the eleven years since the present line was completed will provide opportunities for the use of new methods in the enlargement now being made. The company's three K stations, each with six 500 hp Diesel engines driving 23,000-bbl daily capacity pumps at present are to be expanded to provide a pumping capacity commensurate with the increased capacity of the line. In actual construction of the line, American pressure welding is being employed and mechanical wrappers are also being supplied from America.

Increased pipeline capacity will call for additional loading facilities at Haifa, where two new submarine pipelines of 5,000 feet each are being installed, giving the port permanent loading facilities for six tankers simultaneously. Similar extensions are also to be made to the company's storage and loading plant at Tripoli. The general expansion of the company's activities as a matter of course will require enlargement of many ancillary operations. This will include expansion of the present Kirkuk stabilization plant, and additional laboratory, office and housing accommodation. Except for the small topping plant at Kirkuk and another at Haditha, Iraq Petroleum is not a refining concern. The Haifa refinery is owned by Consolidated Refineries Limited, which is controlled jointly by Anglo-Iranian and Royal Dutch-Shell, two of the groups participating in Iraq Petroleum, while a topping plant at Tripoli is owned by Syria Petroleum Company—an associate of Iraq Petroleum. Authority has been sought recently by Standard of New Jersey and Socony-Vacuum to build a Tripoli refinery.

Each of the controlling groups of Iraq Petroleum receives its proportion of the crude delivery through the pipe lines and is free to dispose of it as it likes. Prior to the war the crude received at Tripoli was largely exported to European refineries of the French and American groups concerned, but following the fall of France in 1940, new arrangements were made for handling this portion of the Iraqi oil, the object being to meet the new situation created by intensification of war in the Mediterranean, with Italy a belligerent. Under these arrangements, Haifa refinery was made the principal source of oil products for the Allies in the Mediterranean area. This involved considerable changes in Haifa operations to meet the war demand for particular refinery products. At the same time, the plant was extended, and now has a capacity of about 90,000 bbl. daily. Deliveries to Tripoli were severely curtailed by war developments in 1941 and 1942. Since then the crude formerly exported from Tripoli has been shipped as a war measure to Haifa for refining.

With the war ended, there is a probability of Haifa refinery operations being modified afresh to bring them back to production on commercial lines instead of for purely war purposes. This could be accomplished without any considerable alteration of design, but the refinery is already working to capacity on existing pipeline deliveries and shipments from Tripoli. Deliveries through the Haifa leg of the line after expansion is completed will exceed the present refinery throughput by something like 50 percent. The pipeline program may, therefore, call for increased refining facilities at Haifa. Anglo-Iranian and Royal Dutch-Shell interests controlling the plant have so far maintained a policy of refining their share of Iraqi crude at the coast.

Meanwhile, Iraq Petroleum is pushing ahead with its plans as rapidly as possible, but owing to disorganization and deficiencies caused by the war, it is naturally meeting many shortages of material and labor. The management is nevertheless determined not to sacrifice efficiency to speed in construction and is prepared to await the demobilization of the right men for its engineering work.

Only a small amount of material has so far been delivered, including about 3,500 tons of pipe, but stringing operations have already started at the Haifa end of the line with the object of giving experience to the teams employed. It is expected that from now on the flow of material will increase rapidly.

Production and Deliveries 1934-44

	Production (Metric tons)	Deliveries (Metric tons) To Haifa	To Tripoli	Total
1934	1,048,000	.....	.....	607,435
1935	3,760,000	1,823,426	1,625,773	3,449,199
1936	3,886,348	1,917,991	2,015,207	3,933,198
1937	4,101,150	1,900,649	2,027,003	3,927,652
1938	4,229,754	2,079,083	2,060,008	4,139,091
1939	3,872,139	1,900,500	2,005,079	3,905,579
1940	2,390,679	1,506,690	915,283	2,421,973
1941	3,879,259	1,200,982	96,144	1,300,557(c)
1942	2,331,191	2,053,137	141,152	2,304,427(c)
1943	3,392,493	2,220,987	994,904(a)	3,341,606(c)
1944	3,993,997	2,266,923	1,559,607(b)	3,912,640(c)

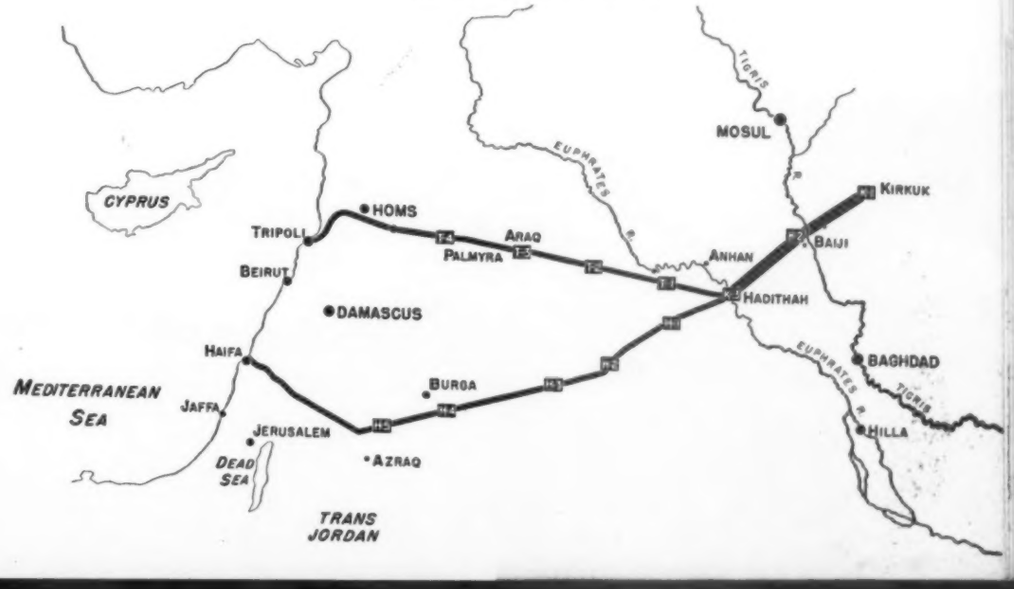
Conversion ratio is 7.481 bbl. per metric ton for Iraqi crude.
(a) Including 186,76 tons of fuel oil
(b) Including 311,084 tons of fuel oil
(c) Including small quantities of products delivered to Kirkuk

Material is shipped partly to Haifa, where it is put on the Palestine state railways for the railhead at Mafrak, Transjordan. The remainder of the shipments go to Basra, to be sent by rail the 500 miles to Baiji, the pipe being carried on each route on cars which the railways have had specially converted for the purpose.

Although the company had been engaged up to the end of 1945 merely in accumulating supplies for construction to begin at the earliest possible moment, it is planned to start laying the pipe in October and the new lines are expected to be ready for operation by 1948. Despite reports of political disturbances in the Near East, the company's officials, judging from their experiences on the spot, anticipate no trouble to the company on that account, excellent relations being maintained with the populations in the operational area as well as with the governments concerned. This applies also to the local relationships of the interests owning the Haifa refinery.

The new line will follow the same route as the present line from the Kirkuk field across the Tigris to a point on the Euphrates river and from there in two branches to the Mediterranean shore, one going northwest to Tripoli

Map of Iraq Petroleum Company Pipelines from Kirkuk to the Mediterranean to be Paralleled with new 16-inch Pipe.



in Syria and the other southwest to Haifa in Palestine. The length of the line between Kirkuk and the point of bifurcation at Haditha on the Euphrates is about 150 miles and from there to Tripoli and Haifa the distances are 380 and 470 miles respectively. A total of 12 pump stations, strung across the desert, keep the oil moving at the rate of two million tons per year through each of the present 12 inch lines. With the laying of the two new 16 inch lines, enlargements of the existing pump stations will be required. In view of the scarcity of water, Diesel pumping units will again be used. Cooled water for these engines is obtained by circulating through heat exchangers counter current to the flow of oil, thus minimizing the requirements for make-up water. The first three pump stations (K1, K2, and K3) are situated along the 150-mile stretch between Kirkuk and the Euphrates, while another four units (T1 - T4) pump the crude through the north line to Tripoli and five pump stations (H1 - H5) bring the oil across the south line to Haifa.

Apart from the enlargements of the pump stations, some additions to the existing terminal facilities will also be required, both in the way of tankage and submarine sea-loading lines. The present terminal site in Haifa Bay comprises 24 tanks with a total storage capacity of 264,000 tons, while there are 27 tanks with a capacity of 305,000 tons at Tripoli. Loading facilities at Haifa at present include four submarine lines in Haifa Bay and two tanker berths in the oil dock of Haifa Port. The extent of the additional tankage and loading lines that will be required at the terminal sites cannot yet be estimated, as this will depend on the size of the refineries to be constructed both at Tripoli and Haifa.

Simultaneously with the construction of the new lines, the enlargement of the stabilizer plant at Kirkuk is to be carried out and work on this scheme is already well in hand. The drilling of additional wells in the Kirkuk field is also in progress in order to provide the increased quantities of crude which will be required to feed the new lines.

Construction of the lines will follow the same pattern as the existing system. The line will be welded but it has not yet been decided whether it will be manual-welded or pressure-welded. Standard equipment will be used in the construction, consisting of ditching machines, back-fillers, tractors, side-booms, bulldozers and welding machines. This specialized equipment will be purchased in the United States, while the equipment for the pump stations will come from England.

Since the latter part of last year, pipe is steadily arriving in Haifa, whence it is being transported on Hejaz Railway to Mafrak in Trans-Jordan, a small station on the edge of the desert, where the pipeline and Haifa-Baghdad road cross the railway. Eastward of Mafrak transport is by road vehicles running either along the Haifa-Baghdad road or across the open desert.

All materials required at the eastern end of the line are shipped to Basrah on the Persian Gulf and thence over the Iraq State Railways to Baiji, where the pipeline crosses the Tigris River.

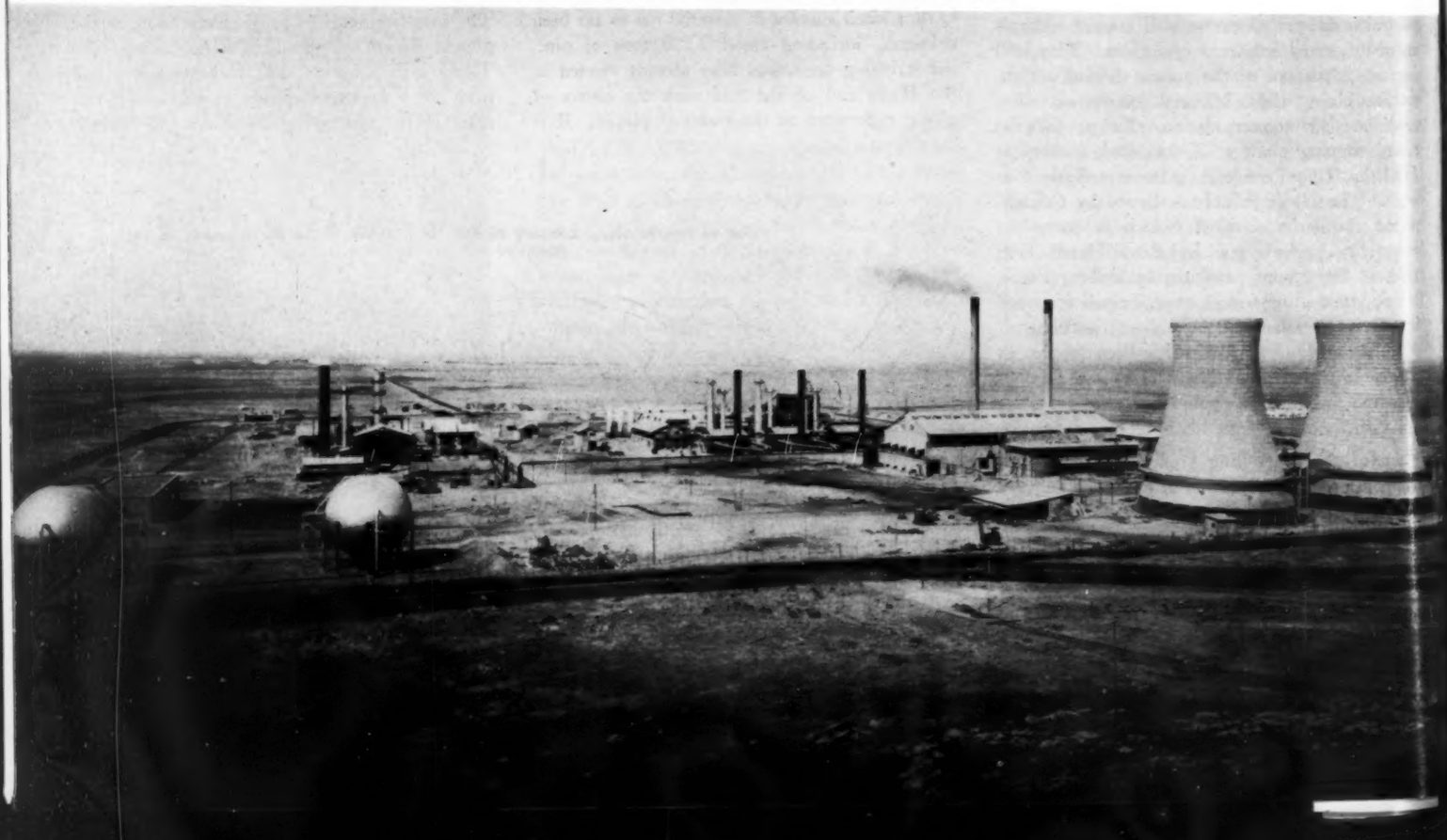
The two small rail stations, Mafrak and Baiji, are thus the western and eastern railheads for construction; locations over the intervening 500 miles are supplied by road haulage from the appropiate railhead.

The provision of additional housing and offices at desert pipeline stations and depots forms a considerable part of the main project. Temporary camps for stores, workshops and personnel are nearing completion at Mafrak, while the building of mainline camps and station construction camps in preparation for the arrival of the construction personnel has begun and repair work on existing roads, bridges and ferries is well under way.

A special department of the Iraq Petroleum Company has been set up to deal with all construction arrangements, but it is expected that contractors will be used for part of the extensive engineering work involved. Apart from British experts and other personnel, some 4,000 local laborers will be employed on the construction when it is in full swing. The south line to Haifa is to be completed first and is expected to be ready in about 2½ years, while the Tripoli line is planned to operate less than a year later.

Expansion of the pipeline capacity and other operations is fully justified by the performance of the Kirkuk field since the first well, Baba Gurgur No. 1, was completed in 1927. Production and delivery statistics from completion of the existing pipelines in 1934 up to the end of 1944, released by the company in January 1946, are given in a table accompanying this article. Oil reserves are fully capable of keeping the additional pipeline facilities employed without any approach to uneconomic field practice, and completion of the new lines will establish Iraq Petroleum more firmly as one of the major producers of the Eastern hemisphere.

K I Pump Station at Kirkuk and Adjacent Stabilization and Topping Plants.



Oil Industry Opposes Further O. P. A. Control

Washington, D. C.

Casting an anchor to windward OPA coupled with its authorization of a 10-cent per barrel increase in the price of crude oil a statement that this was not necessarily its last word on the subject. The rise of a dime, it explained, was necessary to keep earnings from falling below the 1936-39 average adopted as a basis for the industry. The advance, therefore, is mandatory. There remains the possibility that a further increase may be required by rising costs and wages. If a "spot check" now being conducted by the price agency's investigators now in the field shows this to be the case, a further increase will be considered. This investigation is expected to be concluded about April 15 and a decision can be looked for soon after that date. The OPA, however, definitely rejects the recommendation of the industry advisory committee for a price hike of 35 cents a barrel on the ground that this is based on replacement costs and it is contrary to OPA policy to accept such costs as a basis for price readjustment.

Likewise, in stating that the price rise was expected to be absorbed by refiners OPA left itself a possible out by suggesting that there might be instances where the refiners' margin would be turned into an actual loss by the change. Such cases would be given consideration on their merits, the implication being that if a deficit could be shown to exist the gap would be closed by some form of subsidy payment by the government. This has been a favorite method of dealing with such conditions throughout this and the preceding administration. The effect of the price change upon refiners is scheduled for discussion between the OPA and the National Refiners' Industry Advisory Committee.

Action of the Price Administration in its more or less nominal price authorization has met with no enthusiasm in the ranks of the oil industry. Crude producers protest that it is too small to provide them with relief. The large integrated companies that are both producers and refiners are little affected but the small refiners who purchase their crude supplies declare that they cannot operate if they are compelled to absorb the advance on top of other mounting costs.

Charles F. Roeser of Fort Worth, Texas, leading figure among independent operators and chairman of the National Crude Oil Industry Advisory Committee, declared in a telegram to Price Administrator Paul A. Porter: "The ten cent per barrel increase in crude petroleum ceiling prices announced March 5 by the Office of Price Administration is inadequate to maintain the industry's 1936-39 earnings according to the Office of Price Administration standards and it is not labor and steel price. It will not provide a proper stimulant to bring about all the exploration and development efforts necessary to supply future consumer requirements for petroleum products." He warned the "continuance of present price levels and controls will drive many independent producers out of business."

According to Russell B. Brown, general counsel of IPAA: "The amount of the increase will be of some benefit. It will tend to offset, in part, the rise in the price of steel products and labor costs. Perhaps, overall, it will not do much more than that. There must also be taken into due account in the next examination of this subject the restriction in volume of production which has occurred and the further restriction which appears to be probable. On some classes of production this is a matter of great importance."

American Petroleum Institute has turned its attention to the unsatisfactory situation of the industry. At the meeting of its directors held here early in March it was decided to urge upon Congress prompt elimination of price controls of petroleum as unnecessary in the public interest and injurious to the industry. In the opinion of the members many of the difficulties that beset producers and consumers of petroleum products are the result of the continuance of inflexible price controls on a commodity that, as a whole, is now in ample supply.

Members of the board attributed production shortages of domestic and Navy fuel oil to "the unjustified and unrealistic continuance of price controls" and pointed out that they led to interference with normal seasonal adjustments to consumer demand for gasoline in summer and fuel oil in winter.

The discussion led to the decision to present to Congress the strongly-expressed views of the petroleum industry on the imperative need of removing existing regulations. The decision was voiced in the following resolution, which was unanimously adopted.

"Resolved, that the API Board appoint a Committee of Seven to appear before the appropriate Congressional committees for the following purposes:

(1) To explain the present supply and demand situation of the industry and the unbalance and inequities created by the operation of peacetime price control.

(2) To summarize the fundamental difficulties with, and bad effects of, price control in peacetime.

(3) To urge and supply the information which justifies prompt elimination of price control in the petroleum industry.

"It is requested that the committee exchange views with the IPAA. committee on the same subject and, if possible, report back to the API Executive Committee before it makes its presentation".

Following the meeting President William R. Boyd announced the following appointments to the Committee of Seven, authorized to present the Institute's views on price control to Congress: W. S. Hallanan, Plymouth Oil Company, chairman; J. F. Drake, Gulf Oil Corporation; Eugene Holman, Standard Oil Company (N.J.); B. Brewster Jennings, Socony-Vacuum Oil Company, Inc; B. L. Majewski, Deep Rock Oil Corporation; J. Howard Pew, Sun Oil Company; Robert E. Wilson, Standard Oil Company of Indiana.

It is probable that the committee in its presentation to Congress will direct attention to the oft-repeated statement of spokesmen for the Price Administration that price ceilings can and should be removed whenever the supply of a particular product is equal to demand and that it will produce facts and figures to show that in the case of petroleum this condition has been fully met.

In his arguments for continuance of price controls, Economic Stabilizer Chester Bowles frequently points to the "inflationary process" after World War I as a warning of what may develop today without OPA brakes. The API committee can show, if it chooses to do so, that so far as oil is concerned there is no possibility of the repetition of the experience following the first World War when gasoline prices rose to levels of around 29 cents a gallon.

The difference between then and now is that at the end of the first war there was a shortage of oil. Crude jumped 25 cents a barrel at a clip till it got to $3.50 in the Mid Continent and in Pennsylvania sold for $6.10. The supply situation today is quite the reverse. "We've got gasoline running out of our ears" the oil men express it. A recent government survey revealed that the average price of gasoline in the principal cities of the country is 14 cents a gallon. Also, the public is getting a much better gasoline. There was no octane scale at the end of World War I, but oil men figure that the gasoline sold then was only about 50 to 60 octane quality, whereas today the public gets something around 80, and at half the post-World-War I price.

It looks now as though Congress, in spite of the bitter opposition that has developed, would extend OPA's life for probably another year after June 30. But from the welter of debate, it is expected, will come amendments freeing individual commodities from price control where such action is demonstrated to be safe and desirable as production reaches a balance with demand. If that course is followed oil should be in the forefront of products exempted.

MEXICO Revising Oil Distribution

GIVING effect to its previously announced plans for the more effective servicing of the home market the management of Petroleos Mexicanos is proceeding with the establishment of refining facilities at important inland points instead of concentrating them on the seacoast as was the case during the earlier history of the industry when export was a first consideration.

This policy has become concrete with the approaching completion of expansion and general modernization of Pemex's refinery at Atzcapotzalco, D. F., the Mexico City suburb. Reconstruction and enlargement of this plant, which was established by Mexican Eagle (Royal Dutch-Shell) will raise its daily throughput to 40,000 barrels according to Ing. Jose Colomo, chief of Pemex's engineering department, who is directing the technical and labor personnel in the undertaking which is under the technical supervision of Phillips Petroleum Co.

The enterprise represents an investment of 107,000,000 pesos, the largest refinery outlay yet made in Mexico. It is an example of international cooperation in that a $10,000,000 (U. S.) loan by the Export-Import Bank provided for equipment acquired in the United States with the rest of the financing by Pemex. The design and engineering has been directed by the Arthur G. McKee Company of Cleveland, Ohio.

The refinery will serve one of Mexico's largest markets for petroleum products, the Federal District with a population of some 2,000,000 and most of the vast central Mexican plateau, including the Valley of Mexico and many large centers of the middle belt of the Republic.

The refinery's augmented services will be sustained by increased supplies of crude from the Poza Rica fields, Vera Cruz, on the Gulf Coast, by the 238-kilometer pipeline, built by Mexican Eagle and operated by it up to the time of expropriation. The daily capacity of this oleoduct has been raised to 44,000 bbls., nearly double its former flow, by increasing from six to nine the number of pumping stations on the route. The three new stations have been placed at the hump of the steep rise from sea level to the plateau, so that this additional force given ample drive for the increased load.

Units included in the enlarged refinery with their daily capacities in barrels are as follows: primary, 40,000; cracking, 12,000; isomerization, 530; alkylation, 880; fractionization of isobutane and isopentane, 4,800. The power plant contains two turbine generators of 5,000-kva each, and three boilers developing 37,500 lbs. p.h. Storage capacity of 2,000,000 barrels is provided.

Products of the refinery, in barrels daily, will consist of: aviation gasoline, 1,000; motor gasoline, 80-82 octane, 500; 70-72 octane, 4,000; 59-60, 8,600; kerosene, 4,000; tractomax, 1,100; Diesel, 900; combustibles, 1,600, and Pemex gas, 590.

Equipment for the refinery has been supplied by the following companies: Universal Oil Products, Dubbs cracking; Phillips Petroleum Co., alkylation and Perco treating; Shell Development Co., isomerization; Girdler Corp., Girbotol treating; Wyatt, A. O. Smith,, Chicago Bridge and Iron, Mosher Steel and others, steel materials; General Electric and Westinghouse, electrical materials; pumps, Worthington and Byron Jackson; boilers, Babcock Wilcox; coolers, Foster Wheeler.

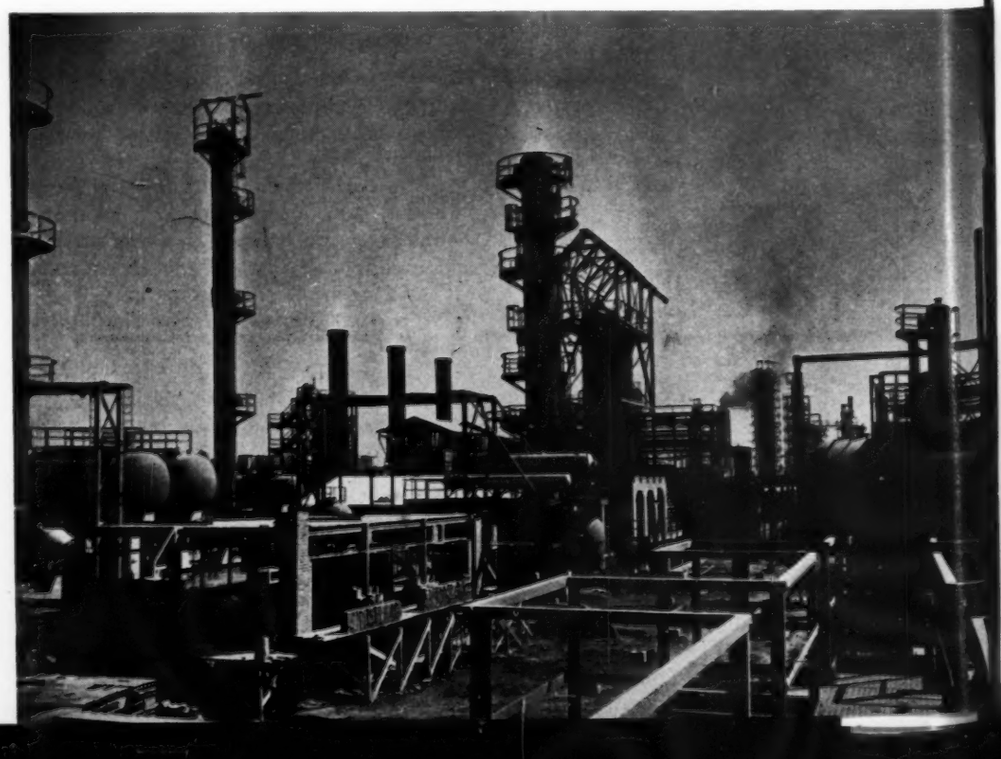
Coincident with the construction of the Atzcapotzalco works Pemex is installing at Poza Rica a crude stablization plant of 65,000 barrel daily capacity; absorption for 75,000,000 cu. ft. of gas daily, and a 5,400 h.p. compressor plant. The three new stations on the Poza Rica-Atzcapotzalco pipeline will each contain centrifugal pumps with 400 h.p. motors.

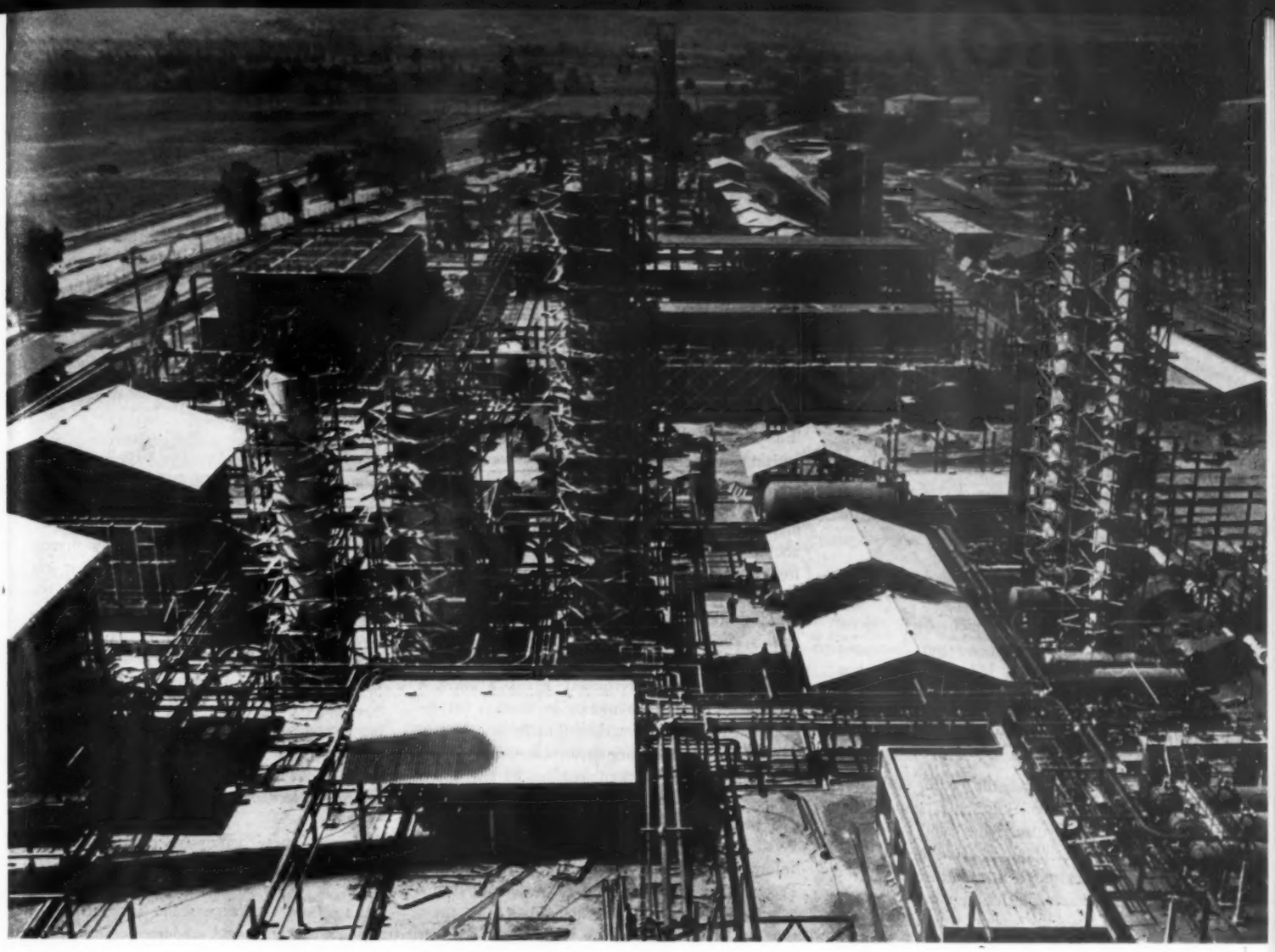
As delays in receiving deliveries of equipment have practically ended, a difficulty that retarded earlier progress, the Atzcapotzalco plant is expected to be able to start on a preliminary basis this month. The other units are expected to follow quickly into service.

The Atzcapotzalco-Poza Rica enterprise is a part of Pemex's program to streamline and modernize its refinery service for the better supplying of the domestic market. This plan features the concentrated operation of five large refineries. The program entails the suppression of two rather small plants in the Tampico sector and the establishment of one, at Salamanca, Guanajuato, almost in the geographical center of Mexico. Details of the Salamanca refinery are now being worked out and are expected to be completed soon after the Atzapotzalcoo refinery gets going completely. This refinery will be equipped to some extent with material from the two plants in the Tampico sector that are to be dismantled. Technicians and workmen of these two plants will be transferred to Salamanca to be employed in its installation and to continue as its staff.

While the Atzcapotzalco and Salamanca refineries are far inland, Pemex is to maintain three on the seacoast - those at Ciudad Madero and Arbol Grande, in the Tampico zone, and that at Minatitlan, Vera Cruz. While the company is

↓ Alkylation and Isomerization units at Atzcapotzalco refinery near Mexico City.





↑ View from the fractionating tower of crude unit at Atzcapotzalco looking toward Cracking Plant, Power House, Boilers and Cooling Tower.

giving greater attention to export trade now that the war is over and recently announced the arrival at a Belgian port of the first large consignment of its products for Europe since the conflict ended, it asserts that foreign business will not be at the expense of the home market and that domestic supplies will in no way be stinted for the sake of business abroad.

Arrangements are being made for the Poza Rica-Atzcapotzalco pipeline to supply the Salamanca plant through an extension from Mexico City and the placing of pumping stations at strategic points on the route.

Pemex is confident that this refinery program, and particularly the operation of the enlarged Atzcapotzalco plant and the one at Salamanca, will solve the problem of adequate distribution of its products to interior points in Mexico. The company has laid much of the blame for admitted inadequacies in past distribution on the government-administered National Railways. The railroad, Mexico's largest, serving three-fourths of the country, retorts by declaring that Pemex is deficient in distribution facilities. However, the railway management has promised that its freight service will soon be improved by the operation of more and better rolling stock over reconditioned rights of way. A commission of rail experts from the United States has been working for some time to rehabilitate the rail-system and has been influential in arranging for additional equipment.

It is reported that Pemex intends later to build a refinery on the Isthmus of Tehuantepec. Such a plant, it is said, could easily be supplied with crude by a pipeline from wells in that zone and from the southern Vera Cruz fields. This plant, the reports say, would not only service southern Mexico but much of the Pacific coast by means of a fleet of tankers from Salina Cruz, principal port of southeastern Mexico. The proposal is advocated as solving the problem of adequately supplying that extensive region.

Ing. Efrain Buenrostro, general manager of Pemex, following an inspection of the work now under way, declared that he is well satisfied with progress that is being made on the refinery and pipeline program. He also said that these operations will be a great contribution to assuring the future of the Mexican oil industry. He reiterated his assurance that servicing the home market with petroleum products, particularly gasoline the demand for which is steadily increasing, will soon be placed on a more effective basis.

Pemex expects to be able to bring production this year to a daily average of around 160,000 barrels. That will be the highest the industry has had since the golden era of the Tampico boom in 1921 and 1922. Increased drilling and improved refinery, pipeline and distribution services are factors in this expected rise in production. Oil company officials maintain that enlarging production is a simple matter of obtaining drilling equipment and construction materials but that they have held output to the demands of the home and export markets. Now that both these markets have improved and servicing facilities are being bettered, production can be increased. They regard the production of high octane gasoline, including fuel for airplanes at Atzcapotzalco as an important forward step in view of the rapid growth of air traffic.

Conversion of DRY NATURAL GAS to LIQUID FUELS

By R. C. Alden*

All of the processes discussed in this report are concerned with the utilization of dry natural gas which, in general (See Fig. 1), is more than 90 percent ethane and lighter, methane being the predominant constituent.

The Fischer-Tropsch Process

The adaptations of the Fischer-Tropsch process are the most promising processes yet developed for the conversion of the lighter hydrocarbon constituents of natural gas into liquid fuels. The Fischer-Tropsch process utilizing coal was initiated in Germany.[2]

As early as 1913, the Badische Anilin und Soda Fabrik in Ludwigshafen, Germany, showed experimentally that hydrocarbons and predominantly oxygenated compounds could be obtained by the catalytic treatment of a mixture of hydrogen and carbon monoxide at high pressures and about 662 F. These experiments were discounted because of the First World War, but were resumed in 1922 and led to the development of the methanol synthesis.

In 1925, Fischer and Tropsch of the Kaiser Wilhelm Institute for fuel chemistry, Mulheim Ruhr developed highly active cobalt, nickel and iron catalysts which could be used at near atmospheric pressures to give chiefly hydrocarbons: gaseous, liquid and solid. By 1930, research was also being conducted along these lines in the United States, Great Britain and Japan. No large scale plants have as yet been erected outside of Germany and Japanese territories. By 1933, this process was in large scale use in Germany. The German process, as of 1939, consisted of two main steps: (a) The production of synthesis gas, a mixture of hydrogen and carbon monoxide, from coal; (b) The conversion of the hydrogen-carbon monoxide mixture into useful hydrocarbons.

Various processes have been described for the production of synthesis gas from coal as the initial raw material and these may be grouped as follows: (a) Synthesis gas made from coke; (b) Synthesis gas made from coke-oven gas; (c) Synthesis gas made from brown coal; (d) Synthesis gas from the complete gasification of coal or coke with steam and oxygen (Winkler and Lurgi Processes).

The end product from all of these processes starting with solid fuels is synthesis gas containing approximately two parts of hydrogen to one part of carbon monoxide with inerts such as methane, nitrogen and carbon dioxide averaging about ten percent of the total mixture. The first process, the conventional regenerative water-gas process gives an initial gas mixture in which the ratio of carbon monoxide to hydrogen is about one. This is iormally too high a ratio for optimum Fischer-Tropsch operation and the gas is usually reformed by converting a portion of the carbon monoxide content catalytically with steam to carbon dioxide and hydrogen. The carbon dioxide is scrubbed out. Often in Germany various combinations of the above processes have been used to fit the particular local conditions.

Before the synthesis gas is used in the Fischer-Tropsch operation, practically all traces of sulfur compounds, both organic and inorganic, must be removed. So sensitive are the Fischer-Tropsch catalysts to sulfur-poisoning that the maximum allowable sulfur content of synthesis gas lies between 0.1 and 0.2 grains per 100 cubic feet. feet.

The first Fischer-Tropsch plants constructed in Germany were operated at approximately atmospheric pressure and the operation was briefly as follows: Purified synthesis gas, containing approximately two parts of hydrogen to one part of carbon monoxide and about ten percent of inerts, is heated to reaction temperatures which is in the range, 350-400 F. The gas is then introduced into specially constructed reaction chambers at a total pressure of about 2 pounds per square inch gauge. The catalyst chamber is cooled indirectly by circulating water. It consists of an outer shell enclosing an array of metal fins approximately 7 mm (0.278 in.) apart. Transversely through these fins are cooling tubes about 4 cm (1.46 in.) in diameter through which water flows as the cooling agent. Catalyst is packed between the fins. Such complicated and expensive reactors are necessary because of the large quantity of heat liberated in the course of the reaction. This amounts to about 7000 BTU for every pound of liquid plus solid hydrocarbon product formed. All of this heat must be removed efficiently and rapidly for the temperature range in which optimum yields of valuable hydrocarbon products are obtained is very narrow. Essentially, the reaction occuring may be designed by the following equation:

$$2\,nH_2 + nCO \rightarrow (CH_2)n + nH_2O$$

The products and uncoverted gas are separated in conventional cooling apparatus. Unconverted gas, which contains besides hydrogen and carbon monoxide, the inerts originally present in the synthesis gas as well as any methane, carbon dioxide and small amounts of propane, butane and butenes, etc., is either sent to a second stage of conversion, if such proves desirable, or directly to an absorber filled with activated carbon, where light oil and gaseous hydrocarbons (C_3, C_4, C_5) are absorbed and recovered. In order to produce gasoline from the heavy oils, they are submitted to a cracking process. In Germany, the True Vapor Phase cracking process appears to be the most successful in this connection.

Although three catalysts, cobalt, nickel and iron, are mentioned favorably in the literature, cobalt is reported as the only one actually being used on the large scale. It is usually promoted with thoria and supported on diatomaceous earth (kieselguhr). The preferred composition is 100 parts cobalt metal to 18 parts of thoria and 100 parts of diatomaceous earth by weight. A portion of the thoria content has frequently been replaced by magnesia.

By 1936, an improved process had been developed in Germany called "The Medium Pressure Process". In all respects, it was similar to the "Atmospheric Pressure Process" except that the operating pressure is approximately 100-150 pounds per square inch gauge and the reaction chambers are of somewhat different design. Slightly higher yields of liquid and solid hydrocarbons are obtained. According to published literature, the "Medium-Pressure Process" is now favored, but the majority of German plants in operation are still of the "Atmospheric Pressure" design.

The composition of initial products from the Fischer-Tropsch process under optimum German operating conditions (1939) may be summarized as follows:

	"Atmospheric Pressure Process"	"Medium Pressure Process"
Gasoline	52%	38%
Diesel Oil	26%	30%
Wax	9%	25%
Bottled Gas	13%	7%

*Director of Research, Phillips Petroleum Co., Bartlesville, Okla.

These data clearly show the increased production of heavier constituents, particularly wax, and the decreased production of gas and gasoline at higher pressures.

The gasoline, end point 392 F, has an octane number of 50, which may be increased to 62 upon addition of 1 cubic centimeter of tetra-ethyl lead per gallon. Reforming this gasoline by thermal cracking results in about a 67 percent yield of gasoline of 70 octane number, which upon addition of 3.5 cubic centimeters of tetra-ethyl lead per gallon increases to 85.

The highly normal paraffinic nature of Fischer-Tropsch oils, while detrimental to their use as high grade aviation gasoline, is nevertheless of great value to their use as Diesel fuel. The Diesel oils boil in the range 382-572 F. and have a cetane value of approximately 100. Even when diluted with an equal volume of aromatic type products produced in the hydrogenation of coal, the resulting mixture is a satisfactory Diesel fuel.

Approximately one ton of the above-described products is obtained for every five tons of bituminous coal used for all purposes: synthesis gas, steam and power, from both the "Atmospheric Pressure" and the "Medium Pressure" processes.

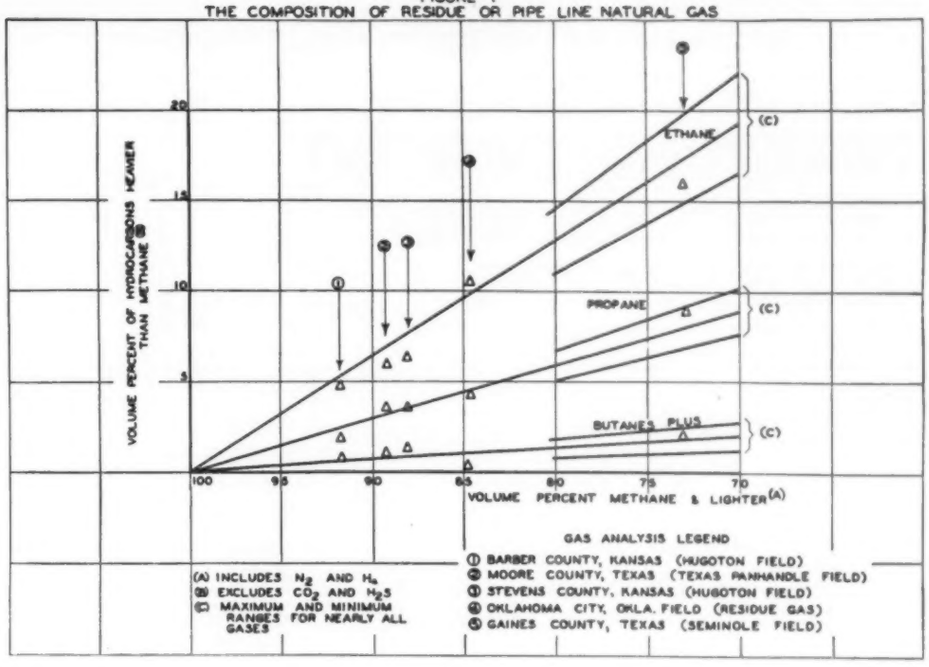
The yield of finished products obtainable from the above initial products depends on the refining processes employed and the nature of the desired end products. If, for example, it is desired to convert the entire initial product as completely as possible into gasoline of motor fuel grade, then approximately one barrel of gasoline will be obtained from 1360 pounds of ash-free and moisture-free bituminous coal.

The general nature of the initial products from the Fischer-Tropsch process when using cobalt type catalysts is shown above. Practically no branched chain hydrocarbons are formed, and this condition is reflected in the octane and cetane numbers of the gasoline and Diesel fuel fractions as described above. The gasoline fraction consists principally of normal olefins and paraffins. Only traces of aromatics (0.1 percent benezene and 0.4 to 0.5 percent toluene) and no naphthenes have been reported. The following hydrocarbons were isolated and identified: pentene-1, pentene-2, hexene-1, hexene-2, 3, 3-dimethyl pentene-1, heptene-1, octene-2, nonene-1, n-pentane, n-hexane, n-heptane, n-octane, 3-methyl octane and n-nonane.

Small amounts of oxygenated products, about 2-3 percent, are produced, such as alcohols, aldehydes, ketones and acids.

The Diesel oil fraction consists predominantly of normal paraffins ranging from decane to octadecane. There are some iso-paraffins but with only slightly branched chains.

FIGURE 1
THE COMPOSITION OF RESIDUE OR PIPE LINE NATURAL GAS



The solid paraffins or waxs, which are reported as being used in Germany for the production of food fats, range from very hard, high molecular weight varieties above those normally found in petroleum fractions to the softer, more common varieties. Their molecular formulas range from $C_{20}H_{42}$ to $C_{150}H_{302}$.

The olefinic content of the initial product fractions decreases as the molecular weight of the product fractions increases. The gasoline fraction may be as high as 35-40 percent, whereas the Diesel fraction is around 19 percent unsaturated. The waxes are completely saturated. The C_3-C_4 fraction may run as high as 50 percent unsaturated. Considerable use of the olefins, particularly those produced from cracking of the initial products, has been made in Germany for the production of synthetic lubricating oils.

Large Scale Production in Germany

The significance of the process to the German oil program during the recent war may be adjudged by the following figures: In 1933, the Ruhrchemie erected a plant of 7000 barrels per year capacity at Oberhausen, Germany. At the end of 1936, there were five Fischer-Tropsch plants in Germany with a total capacity of 805,000 barrels of oil per year. During 1937-38, this capacity was doubled by the erection of new plants and during 1939-42, it was again increased. In 1944, the estimated capacity of all German Fischer-Tropsch plants was placed at about 5,590,000 barrels of gasoline, Diesel oil, lubricating oil and parraffin wax. This is estimated at somewhat less than one-tenth of the oil production vailable to Germany.

Potential Significance of the Process in the United States

The potential value in the United States of hydrocarbon synthesis analogous to the Fischer-Tropsch process includes not only the utilization of coal, but also natural gas. Although there are no commercial plants of this nature in the United States at the present time, it is generally agreed that the natural gas process is somewhat simpler and cheaper to operate and with sufficient advancement may become considerably more economical.

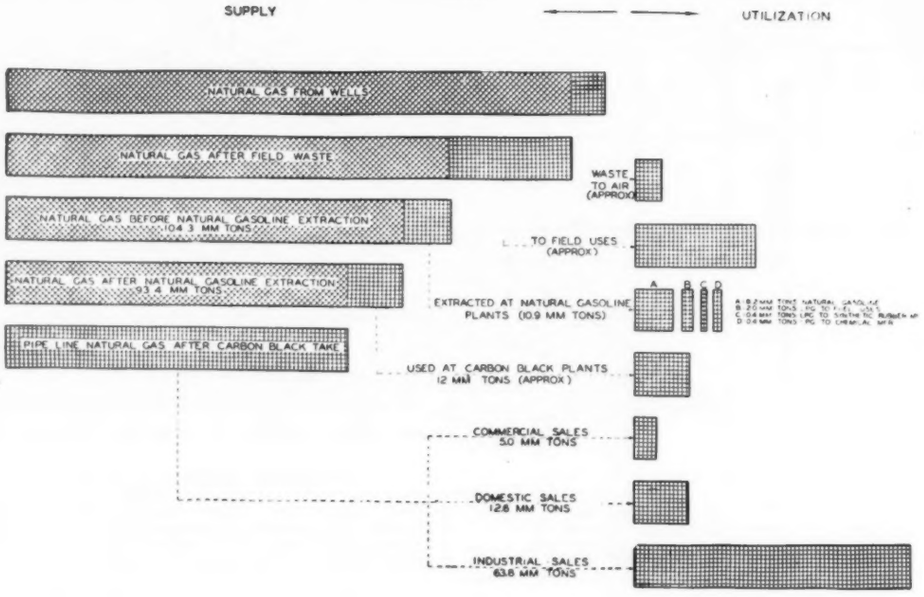
A large amount of research and development work is being done in this country by private industry. The results of this work have not been publicly reported. Iron catalysts may be of considerable importance in this country because among other effects larger amounts of oxygenated products,predominantly ethyl alcohol, are produced. The market for cheap alcohol is potentially a large one if the price is low enough to permit its use for butadiene production. Iron catalysts also produces an initial product of higher octane number, thus reducing the amount of refining necessary.

All of the processes for making synthesis gas, starting from natural gas, are based on combinations of the following three reactions:

a) $CH_4 + \frac{1}{2} O_2 \rightarrow CO + 2H_2$
b) $CH_4 + H_2O \rightarrow CO + 3H_2$
c) $CH_4 + CO_2 \rightarrow 2CO + 2H_2$

Reaction (b) is presently utilized on a commercial scale in the United States for the preparation of hydrogen for industrial purposes. However, by this reaction a gas too rich in hydrogen is obtained for use in Fischer-Tropsch type operations and it would be necessary to modify this reaction by one or both of the other reactions. Such a process is not at all difficult for all three reactions proceed under the same conditions of operation. It is merely necessary to combine the reactants in the proportions re-

FIGURE 2
TONNAGES OF NATURAL GAS
TO VARIOUS USES
(1944)


SUPPLY
UTILIZATION
NATURAL GAS FROM WELLS
NATURAL GAS AFTER FIELD WASTE
WASTE TO AIR (APPROX)
NATURAL GAS BEFORE NATURAL GASOLINE EXTRACTION 104.3 MM TONS
TO FIELD USES (APPROX)
NATURAL GAS AFTER NATURAL GASOLINE EXTRACTION 93.4 MM TONS
EXTRACTED AT NATURAL GASOLINE PLANTS (10.9 MM TONS)
A
B
C
D
PIPE LINE NATURAL GAS AFTER CARBON BLACK TAKE
USED AT CARBON BLACK PLANTS 12 MM TONS (APPROX)
COMMERCIAL SALES 5.0 MM TONS
DOMESTIC SALES 12.8 MM TONS
INDUSTRIAL SALES 63.8 MM TONS

quired to produce an end gas containing two parts of hydrogen to one part of carbon monoxide. A typical process would be as follows: Natural gas and the appropriate quantities of steam, carbon dioxide or oxygen are heated to reaction temperature which is about 1600 F. The heated gases are passed at around atmospheric pressure into a reactor consisting of parallel small diameter tubes packed with catalyst and heated by direct firing in a radiant down-flow furnace. The carbon dioxide as one of the reactants may be obtained from several sources, for example, it may be extracted from the tail gases of the preheaters in the synthesis gas production step. In the German operation, the sulfur content of the synthesis gas must be reduced to 0.1-0.2 grains per 100 CF and if this handicap persists, it will introduce added operating costs in the case of natural gas containing too much sulfur. Yields of finished gasoline starting with natural gas have been variously reported. The most conservative estimate[8] based upon 1939 European design of the synthesis step is about one barrel of gasoline per 11,950 cubic feet of methane or 3.5 GPM (gallons per thousand cubic feet). This is based on ultimate yield of finished gasoline utilizing thermal cracking on the Diesel oil and wax. It is also based on total consumption of natural gas in the process for production of synthesis gas, steam and power. Lower published estimates[8] based on possible future design reduce the quantity of methane consumed per barrel of finished gasoline to 10,450 cubic feet or 4 GPM. In Table I, a comparison of the yields from coal and from natural gas are given. Also included are the BTU contents of the initial and final products.

It is readily seen that the conversion of coal is less efficient than the conversion of natural gas at present. Further research, however, may improve the efficiencies.

From 1000 CF. of methane, allowing none for fuel requirements, it is theoretically possible to obtain about 6.5 gallons of motor fuel. The fuel value of this 6.5 gallons of motor fuel will be about 75 percent of the fuel value of the original 1000 CF. of methane. Therefore, the maximum fuel value recoverable is as above, some methane will be required for fuel purposes. Consequently yields will always be less than 6.5 gallons per thousand cubic feet of methane or the fuel value of the motor fuel will always be less than 75 percent of the fuel value of the methane used to produce it. Improved reaction efficiencies and, particularly, improved techniques of synthesis gas production will no doubt reduce the amount of gas required so that net yields as high as 4.5 to 5.0 GPM then may be obtained in large scale operation.

For every cent of cost per M cubic feet of methane with 50 percent of the fuel value converted to gasoline, the raw material cost alone will be $0.0024 per gallon of gasoline. Since so much of the heating value of natural gas is lost in this process, the possibility of expanded uses for natural gas itself as a direct motor fuel or for heating purposes should not be overlooked.

The potential utilization of natural gas for hydrocarbon synthesis definitely bears a strong relationship to both the natural gasoline industry and the natural gas fuel industry. In the former case, the relationship is purely complementary, while in the latter the relationship may be competitive with respect to raw material. The production of natural gasoline is a well-established and essential industry, producing large quantities of motor fuel from the heavier constituents of natural gas. It produces enormous quantities of dry natural gas which are currently sold as fuel or restored to the ground as a conservation measure.

The use of the synthesis process to dispose of excess quantities of dry gas and as a leveling agent for fluctuations in demand for natural gas for heating purposes is potentially attractive. The integration of these three operations: synthesis, natural gasoline and natural gas as fuel represents a complicated task and depends on localized conditions, fluctuations in market demands and so forth.

The question of coal versus natural gas as a raw material for Fischer-Tropsch type processes in the United States is fraught with many angles. All of the arguments, pro and con, may be grouped according to relative economics, efficiencies of utilization and over-all reserves of coal and natural gas available. Table II following shows the relative cost of production of gasoline using coal and natural gas as the starting material.

These are conservative published estimates. Costs as low as 5 cents per gallon[1] have appeared in the literature based on 10 percent return on investment and certain favorable local conditions. At any rate, there is general agreement that gasoline from dry natural gas as a starting material is cheaper to produce than the same product

TABLE 1
FISCHER-TROPSCH YIELDS STARTING WITH COAL AND NATURAL GAS

Raw Material	Raw Material per barrel of Gasoline Produced	Fuel Value of Initial Raw Material per Bbl of Gasoline Produced Therms/bbl Produced	Fuel Value of 1 Barrel Gasoline Produced Therms/bbl	Percentage of Fuel Value of Raw Material Converted to Gasoline
Coal	1360 lbs.	163.0	50.5	31.0%
Methane (European Design)	505 lbs. (11950 CF.)	119.5	50.5	42.5%
Methane (Possible Future Design)	440 lbs. (10450 CF.)	104.5	50.5	48.3%

from coal as the raw material at the present time. The raw material cost alone of coal per barrel of gasoline would probably average somewhat greater than the cost of natural gas. With the relative cost of production of gasoline using cubic feet, its cost per barrel of gasoline produced (10,450 CF/barrel) is approximately $0.53. To compare favorably with this cost, the price of coal per ton would have to be about $0.78 on the basis of 1360 lbs. of coal per barrel of gasoline produced. With natural gas at ten cents per MCF, the equivalent price of coal would be $1.60 per ton. On the basis of conservative published estimates, the synthesis process utilizing natural gas will not be able to compete with present refinery methods utilizing crude petroleum until the price of crude reaches about $1.75-2.00 per barrel. On the basis of more optimistic published estimates, the process is competitive now at about 10 percent depreciation on capital investments.

The efficiency of utilization of natural gas has already been shown in Table I to be greater than that of coal.

Counteracting these two advantages for the use of natural gas as the raw material is the question of total reserves. The reserves of coal in the United States suitable for use in this process amount roughly to 1.4 trillion tons, equivalent approximately to 2.1 trillion barrels of gasoline. A conservative estimate of the natural gas reserves is 100 trillion cubic feet which is equivalent to 8.36 billion barrels of gasoline or ½ percent of the supply available from coal. If a yield of 50 percent of gasoline is obtained from the roughly 20 billion barrels of known oil reserves, this is about 10 billion barrels of gasoline, an amount about equal to that obtainable from the gas reserves. Although the conversion of natural gas may be important from the standpoint of augmenting raw materials for liquid fuels manufacture at costs not far from present costs, it cannot be considered an ultimate solution of the question. In short, the utilization of natural gas for hydrocarbon synthesis represents an "intermediate", but important, process and as such has greater immediate interest than coal. If gasoline were produced from dry natural gas at the rate at which gasoline was consumed in 1940, the natural gas reserves would last conservatively about 15 years.

Interest in Fischer-Tropsch type processes in the United States has grown tremendously within the last few years. Not only have large sums of public money been appropriated for government research along these lines, but private industry, including both petroleum and coal interests has also been carrying on extensive research. Ten years ago, published information indicates only three companies, Kellogg, Standard Oil Development and Koppers were actually engaged in research on curtailed for lack of funds in 1930 and not resumed extensively until appropriations were made in 1944. At the present time, many other companies are known to be studying the process. Several companies, including The Texas Company and Petroleum Hydrocarbons[4], Inc., have announced plans for undertaking pilot plant operation. The Kellogg Company[5] recently announced their readiness to license and construct plants to produce gasoline at five cents per gallon from natural gas (estimate qualified by 10 percent depreciation, access to water and refinery utilities). It is understood that plant design and contractual relationships are going forward in regard to several possible large scale operations by private industry. The intensity of interest in this country is further shown by the number of articles published within the last year in American technical journals as compared with publications ten years ago. Within the last year, approximately 15-20 reviews and experimental reports have appeared, while in 1935 articles were almost completely restricted to foreign sources.

Although the work sponsored by the United States Government at the Bureau of Mines and that currently being undertaken by various private concerns in the petroleum and natural gas industries are both directed towards the production of hydrocarbons from mixtures of hydrogen and carbon monoxide, their viewpoints are different in at least one major aspect. The government's viewpoint is long-range and is based on the utilization of coal as the initial raw material, whereas the major portion of present activity in private industry is concerned with the utilization of natural gas. Considerable "know-how" has already been built up in the petroleum and natural gas industries concerning this utilization of natural gas. As pointed out above, the synthesis of hydrocarbons starting with natural gas is at present more economic and efficient than starting from coal and, therefore, is of more immediate interest as a further measure of conserving a raw material already being removed from the ground. Since the second step in the process, the conversion of synthesis gas to hydrocarbons, is the same regardless of whether coal or natural gas is used as the initial raw material, it is obvious that the petroleum industry is in a good position to gain considerable knowledge of value in the long-range program based on coal utilization, as well as to exploit the process commercially at an earlier date utilizing natural gas.

TABLE II
COMPARATIVE COSTS OF FISCHER-TROPSCH GASOLINE[3]

	Approximate Dollars Invested per bbl. Motor Gasoline/day	Approximate Gasoline Direct Cost, Including Normal Overhead but Excluding Depreciation, per Gallon	Approximate Gasoline Total Cost, Including Normal Overheads and 10% Depreciation, per Gallon
Fischer Process European Design Starting from Coal-----	$7600	14.7 (a)	19.2
Fischer Process European Design Starting from Dry Natural Gas------	$4750	6.0 (b)	8.8 (c)

(a) Coal at $2.75 per ton

(b) Natural Gas at 5c/M

(c) Depreciation on this basis is 2.8 cents per gallon. Thus with natural gas at 10 cents per M just the feed stock and depreciation together would amount to 5.8 cents per gallon of gasoline.

Other Potentialities of Liquid Fuels From Dry Natural Gas

Adaptations of the Fischer-Tropsch process offer the most promising methods of converting dry natural gas into liquid fuels at the present time. However, other methods show signs of becoming important in the future. Of these, the direct conversion of methane and ethane to liquid fuels by high temperature pyrolysis has received considerable attention in the past. From 1928 through the thirties, studies were made independently in England, Germany and the United States. As early as 1927, the Anglo-Iranian Oil Company was reported to be producing on a semi-commercial scale as much as 0.26 gallons of benzene per 1000 cubic feet of gas containing 80 percent methane. In 1931, the United States Bureau of Mines[6] reported the following yields from 1000 cubic feet of methane: 0.3 gallons of light oil, largely benzene, 2.5 pounds of liquid tar containing about 35 percent of naphthalene and 65 percent of unknown hydrocarbons. In

(Continued on page 70)

MOTOR TRUCKS of the FUTURE

New Fuels, Supercharging, Injection, Gas Turbines, Hydraulic and Electric Drives Hold Promise but Face Important Problems

AMERICAN business invests about a billion dollars yearly to replace 750,000 trucks out of the five million on the road, Robert Cass of White Motor Co. told the recent annual meeting of the Society of Automotive Engineers. The motor truck represents a transportation industry involving six million men which, with their families, represents a good size segment of the total population.

It is very easy to see, he said, how any change in the economic picture of this industry from the standpoint of design and manufacture can and does have a very large effect on the cost of living as distribution costs are a major item in commodity prices. And many significant changes are in prospect.

The first point to be considered about the truck of the future (that is, in the next five years, which is as far as it now seems possible to foresee) is the truck's power plant. Two types of engines come into the picture - the gas turbine, and the conventional reciprocating engines. Each of these engine types have to be considered from five standpoints: size thermal efficiency, maintenance, weight, and cost. The gas turbine, which showed startling developments during the war, holds much promise but faces important problems. From the standpoint of size, it can unquestionably be made to take up less space than similar reciprocating engines and their cooling systems. Present fuel consumption is about twice that of the conventional type engines and this must be cut down if real progress is to be made. The cost picture, with automotive production technique, should be favorable.

One of the greatest problems connected with the gas turbine lies in the engine speed which is much greater than that of the orthodox engine, the ratio being at least 4 or 5 to 1. Although it is possible to mount the rotating shaft on anti-friction bearings, the life would be limited as in present aircraft installations. Power transmission, making use of electric or torque conversion, would be necessary and these await development. Another problem connected with gas turbines is one of metallurgy, to permit the long life which has become an established standard in the truck field.

These are difficult problems, but there is no gainsaying the many advantages that may come from such an essentially simple engine.

Consultation wtih people interested in the fundamental development of small size gas turbines seems to indicate that there are no major drawbacks to making the power plant in sizes perhaps of 300 horsepower occuping a smaller cooling system, etc. It is considered reasonable that we could stand a higher specific fuel consumption, as the fuel picture lends itself to the use of lower price fuels and gasoline. The specific fuel consumption of the gas turbine at the present time is roughly twice that of our orthodox truck engine and even though the fuel may be less in cost per gallon, the real progress can only be measured in an increase in output per cubic inch for each pound of fuel used.

In the sizes contemplated for the truck picture, they see no need for a cooling system as the temperature suggested - 2000°F - would be maximum and any added efficiency which came from cooling and regeneration of any kind would add relatively little in the total overall economy picture, but would add a lot of complications.

In the conventional engine tremendous possibilities are seen in the new fuels and in supercharging. These should make it possible to raise the BMEP up to at least 180, offering a great increase in engine output without sacrificing maintenance standards.

The economics of truck transportation demand that the power transmission line be reduced in weight and cost, and it is expected that the price per horse power of the engines will be reduced. Due to new fuels and supercharging the size of engines should be reduced, so that engines of around 600 cubic inches may be cut to something over 400 cubic inches, resulting in a reduction of cost and weight. This, of course, will call for an improvement in the vital parts. To make possible the lower weight per horse power, using common materials, will require a fuel of 90 to 95 octane and lubricating oils that will handle temperature well over 250 degrees. Future truck engines of 300 horse power are not an impossibility.

Passing to the various engine parts, piston rings come under the spotlight and it is evident that their life is still far short of what is needed for the higher output engines. When better materials are developed, reasonably priced rings which will withstand high temperatures and pressures will become a possibility.

Standard design pistons satisfactory to present engines fail at the higher BMEP's and temperatures to offer service within the expectancy. And again, we cannot consider aircraft prices or aircraft engine life as a criteria. Materials and methods must be developed to meet these higher requirements.

When it comes to bearings, there is need for change in bearing construction and materials, particularly in the main bearing, connecting rods, and wrist pin bearings. New alloys to take the pressure increase must be considered. A great deal of research has been done in this field. Highways like the Pittsburgh Turnpike are going to require new bearing qualities.

To make possible the output desired in future trucks, liquid-cooled valves will assume greater importance than ever, and more and more materials such as sodium will be required.

"Of the supercharging units, the centrifugal type seems to be most desirable because it can be more readily driven from the engine exhaust system and we can thereby get the boost at the time we want it. Weight-saving possibilities per horsepower gained offer real advantages over the relatively larger engines which would otherwise be necessary to affect a power increase. Fundamentally, the supercharger installation should not cost more per horse power gained than the cost of the same power increase in a larger engine. The weight saving possibilities of the supercharger should be considered a plus.

The injection system is obviously a part of future engine development which should be pursued with vigor in the next five years both as to cost, which at present is much too high and to characteristics which will have a marked effect on maintenance. A carburetor is a simple instrument to maintain. Further, it would seem that with a gasoline engine designed for an injection system, size for size with a carbureted engine, we should obtain at least a 25% decrease in fuel burnt.

Claimed to be the World's Largest Truck Tanker, this Unit Hauls 12,000 Gallons per Trip for West Oil Co. of Detroit. Gross Weight of Train is 135,050 Pounds.

↑ Fleet of Diesel Powered Trucks Operated by Hills Transportation Co., San Francisco and Los Angeles.

↑ Northern New Jersey Oil Company's Tractor-Semi-Trailer Diesel Powered Fuel Tank Truck.

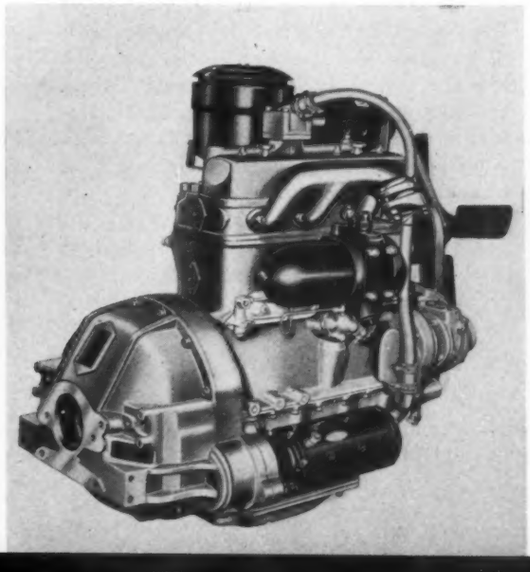
In this discussion only gasoline engines are mentioned because it seems that the major development in reciprocating engines will center around that type of engine. The fuel picture is predominantly in favor of gasoline engine progress in truck engines and there are other economics outside of fuel that may still further influence our thinking.

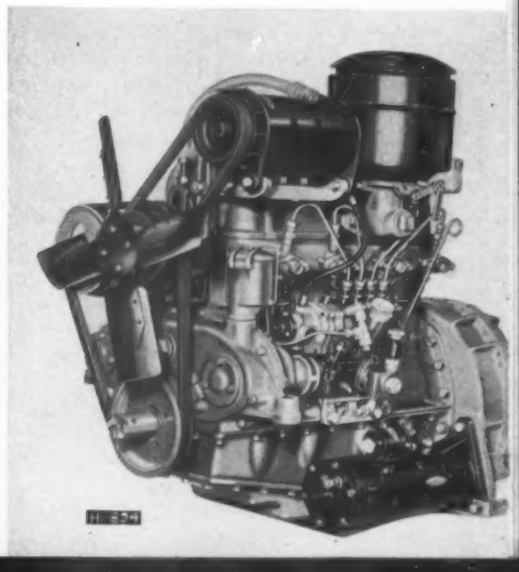
The cooling system trend will call for the development of other solutions than water. There is a possibility of reducing the size of the conventional radiator through proper plumbing and pumps designed for pressure operations. Oil coolers are badly needed. These are problems for petroleum chemists.

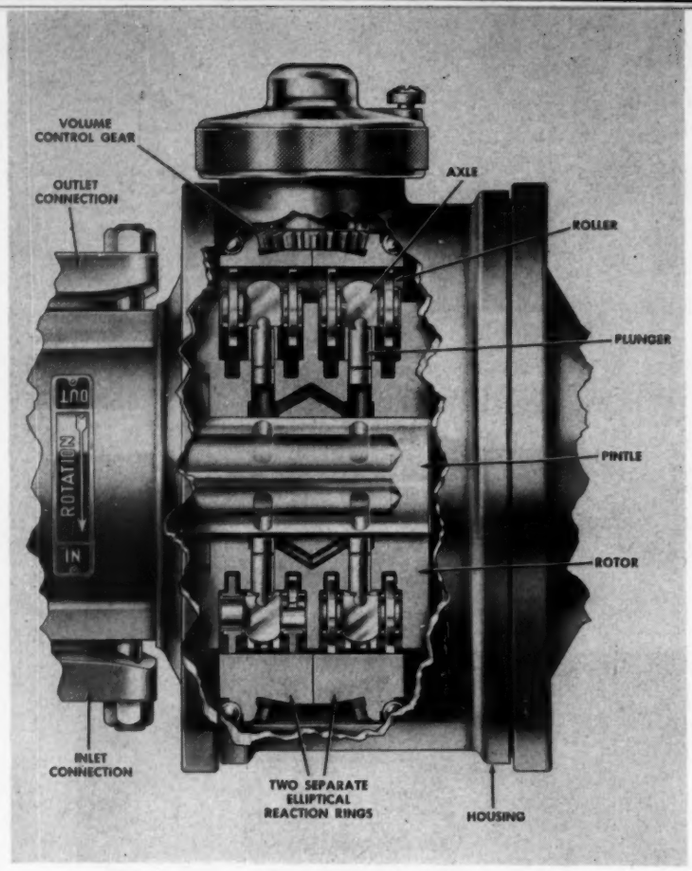
As far as transmissions are concerned, there is a great deal of speculation in view of the automatic transmissions introduced on automobiles and busses. Ultimately we will replace the present gear boxes with some easier form of gear changing apparatus, particularly in city work and where much use is made of transmission ratios. It is desirable to make ratio changes on the basis of power requirements and not speed. Very serious consideration should be given the automatic transmission using a fluid means of transmission.

Driver comfort, safety, and the elimination of sideway and load shifts will be the considerations in any improvement of suspensions. Springs which would improve the ride under a light load and progressively increase resistance to a heavy

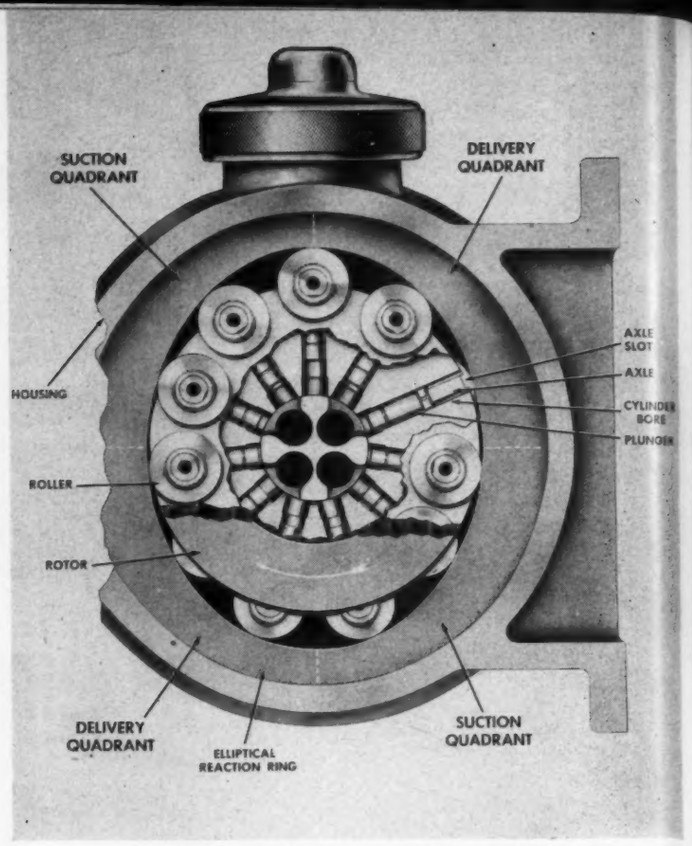
↓ Compact Diesel Engines Have Been Designed by Hercules for Ford and Chevrolet Replacement Motors. Unit at Left is for Chevrolet and at Right is for Ford Trucks.







Cutaway View of Variable Delivery Superdraulic Pump Considered Possible for for Application of Hydraulic Drive to Automotive Vehicles.



This Sectional, Partial Cutaway View of Superdraulic Pump Emphasizes the Function of the Eliptical Reaction Ring and Shows How Each Plunger Passes Through Two Delivery Strokes with Each Revolution of the Rotor.

load would be welcomed. Controlling sidesway by automatic means is a definite possibility in trucks of the future.

Rubber seems to be standing at the threshold of great developments and this leads to a consideration of the tires. It has long been known that speed naturally is a destructive element as far as tire life is concerned in that there is an increasing tendency of the tires to heat up to the danger point. Yet, in spite of this, the curve of actual life using thousands of tires as a basis, indicates that with the increase of speed, the tire life has always, with but one exception during the last ten years, gone up considerably, the gain never falling much lower than five or six percent and sometimes being as high as ten percent. Looking into the possibilities of tires for these vehicles we see the possible use of different rayons, nylon, and steel wire. Wire is ten times as strong as cotton which, for a long time, was the standard tire cord. We are aware of what has happened to rayon tires and we may well look forward to other tyes of synthetic cords. In the next five years tire manufacturers will offer safer tires with longer life even at increased speeds.

We are reaching the end of the straight mechanical gear era in steering units, and there is now a need for quicker, easier control. Power steering is getting more attention than it deserves, but a spectacular development may spur progress. Weight and cost must both come down. Although present steering gears are good, they require too much physical effort, and some power assistance must be considered in the future. This may take the form of hydraulic or electric power.

The question of braking with respect to large vehicles running at high speeds is an important one. It would seem important that brakes of a different form than now used be developed in line with the conditions. For this we might well look to the hydraulic and electrical fields.

Finally, the safety and comfort of the driver is highly important. This means a thorough study of the cab and the development of a comfortable seat, clear vision, and air conditions, as well as automatic controls.

About the time Mr. Cass was presenting the paper as abridged above, the Superdraulic Corp. was exhibiting a newly designed hydraulic generator which caused the magazine "Diesel Progress" in its next issue to ask: "Will automotive drives be full hydraulic?" The publication went on to suggest that the revolutionary hydraulic generator may open the way to simple, direct hydraulic vehicle propulsion and power transmission because of its ability to deliver high pressure plus high volume without benefit of accumulating equipment.

The model shown is small enough to be held by a man but is capable of developing a pressure of 5,000 lbs. per square inch and 40 horsepower. At 1200 revolutions per minute it delivers up 17 gallons of hydraulic oil per minute. Two models have been designed, one for constant delivery and the other for variable delivery for varying power requirement. The pressure developed-5000 psi., is double the pressure previously obtainable.

Hydraulic pumps for application of pressure are of course well known in many industries where high pressures are required for compression purposes. Previous attempts to use such pumps for hydraulic power transmission have not been a success in maintaining uniform high pressure for continuous duty in the operation of a turbine or other source of mechanical power. In other words, the problem of full hydraulic drive has up to now not been wholly solved. The new hydraulic pump overcomes the pre-existing difficulties, and the way is now open for operating all kinds of machinery, including automotive engines, oil well drilling machinery, sugar cane crushing mills, and other equipment which can be served by a single source of high pressure and high volume which in many hydraulic circuits dispenses with double pumps and cumbersome intensifiers and accumulations.

One of the large electrical equipment manufacturing companies has another approach to the same idea in course of development. The idea consists of a radically new type of "pancake" motor with a short rotor which can be installed readily on motor vehicle wheels. The manufacturers are working on a diesel-electric or gasoline engine-electric drive with driving motors on all four wheels.

Capital Sidelights on Oil

By W. J. Maddox, Chief of World Petroleum Washington Bureau

Hand Joins Parsons Co.

Allan H. Hand

ALLAN H. HAND, who served as executive secretary-treasurer of PIWC during the war, is now vice president of The Ralph M. Parsons Company, Los Angeles, engaged in "digging up" business for the concern. Although he expects eventually to make his headquarters in Los Angeles, his present plans are to work out of Washington for probably three to six months before making the change.

Before coming to Washington to aid in the war effort, Hand had extensive experience in the oil business in California. For more than 27 years he was with the Union Oil Company, and when the company was reorganized in 1939 he resigned and opened his own business as petroleum economist and consultant and as an oil transportation broker. He closed up his personal business when he was called to Washington in June, 1941 by the Office of Petroleum Administration and Civilian Supply.

Mother Hubbard Suit Bobs Up

HAVING lain dormant and almost forgotten for more than five years due to the war, the old "Mother Hubbard" suit—covering everything and touching nothing—brought by the government against the API and a number of major oil companies and their subsidiaries charging unlawful monopoly, price fixing and conspiracy in violation of the anti-trust act, came to the surface recently in District Court here and a 90-day extension was given defendents for filing pleadings. The suit originally named 22 majors and some 350 of their subsidiaries and affiliates. The case against one major and 48 subsidiaries has since been dismissed, however.

The Department of Justice is understood to be a bit doubtful as to the strength of its case and would be happy to forget the whole thing by having the companies come in and make their peace in the form of a consent agreement—promise not to do the things alleged any more. This, however, would be a virtual admission by the defendents that they were guilty. Government officials are hopeful, though, that the 90 days will bring a peaceful solution that will keep the case out of court. Special Assistant to the Attorney General Watson Snyder is handling the case for the government.

Council Plans Dropped

PLANS for a National Petroleum Council to carry on the liaison between the government and industry so ably performed by the now defunct PIWC during the war are being abandoned. A poll of former PIWC members failed to get the two-thirds favorable votes necessary to put the proposal across. Of the 75 former members polled, 42 voted for the new council, 21 against, 2 non-commital, and 10 made no reply.

Curmudgeon's Successor

Julius A. Krug

IN taking over the Secretaryship of Interior March 15th, Julius A. (Cap) Krug inherited all the many jobs held by Mr. Ickes on his retirement from the Cabinet, including that of petroleum administrator and other wartime duties that have not yet been fully liquidated. At 38 he will be the youngest man in the Truman Cabinet, a contrast with Ickes who was close to 72.

While the new Secretary of Interior has no oil background, he has proved himself an able administrator, particularly in the trying job of chairman of the War Production Board. His nomination was one Truman selection that got ready Senate approval, although some of the Western bloc members would have preferred a man "familiar with Western problems" as they concern public lands.

Krug's interests and background are chiefly with public power projects. In prewar days he was power manager of the Tennessee Valley Authority, and it was he who negotiated the 80-million-dollar deal with Wendell Willkie whereby TVA acquired the properties of Commonwealth & Southern. He came to Washington in 1941 to become chief power consultant to OPM, which later became WPB. In 1943 he was made the nation's power czar with full authority over electricity, gas, water supplies and communications. In 1944, while vice chairman of WPB, he entered the Navy as a Lieutenant Commander, but later that year when Donald Nelson and vice chairman Wilson locked horns, President Roosevelt called him back and gave him Nelson's job as boss of WPB.

Since WPB passed out of the picture last October, Krug has been serving as consultant to industrial concerns. In stepping out of government service he said: "Let's get out of the way of private business". At the same time he strongly warned the country to keep its war-developed industrial power strong and ready to meet "dangers inherent in the world situation."

Rubber Supply Insurance

RFC's reopening of the government-owned plant at Institute, W. Va., to resume making butadiene from alcohol is not to be taken as indicating a present shortage of synthetic rubber but merely insurance against a shortage developing "in the coming months which might have the effect of reducing the output of critically needed rubber goods", say Rubber Reserve spokesmen. Nor will it have any effect on the rate of manufacture of tires, tubes, and other civilian rubber products.

Operations at the Institute plant were suspended by RFC in November 1945 and the plant placed in a standby condition. Increased supplies of natural rubber were looked for from the newly liberated Far East producing areas. Since last fall, however, substantial revisions in the estimates of natural rubber available have been made. It is now expected that the United States may receive about 250,000 to 300,000 long tons in 1946 —100,000 tons under the estimate made in the fall of 1945.

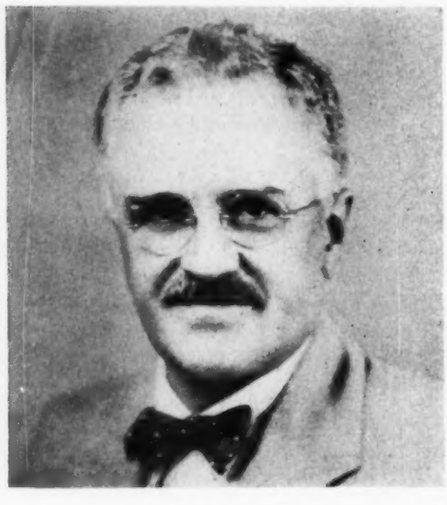
Heads Oil-from-Coal Lab.

Dr. L. D. Schmidt

DR. L. D. Schmidt, who is to be supervising engineer of the Bureau of Mines' new oil-from-coal laboratory on the campus of the University of West Virginia at Morgantown, is a chemist of broad experience in private industry and in the Bureau's fuel laboratories at Pittsburgh. He will serve as chief of one of the new laboratory's three sections, that on briquetting and coking.

The other two section are gas-making processes and gas treating and testing. The former is to be headed by G. R. Stimbeck, former supt. of the coke and gas division of the Morgantown Ordnance Works. Other appointments as a nucleus of the staff of about 20 which will man the new laboratory are: J. L. Elder, chemical engineer; A. E. Sands, chemical engineer; H. G. Graham, mining engineer; M. W. Wilson, chemist; F. J. Breneborg, scientific aide; Ruby B. Baker, administrative assistant; and Ruth F. Lawrence, purchasing agent.

Oil Company Staff Changes



Dr. Walter Miller

E. M. Butterworth

DR. WALTER MILLER has retired as vice president in charge of manufacturing, Continental Oil Co., it was announced by Dan Moran, Continental president.

Dr. Miller came to the United States from Switzerland when he was a small boy. In 1909 he went to the Bayonne, N. J. refinery of Tide Water Oil Co. as yield clerk. He reached the rank of process superintendent and then resigned to join Pierce Refining Co., Tulsa, as general superintendent of three refineries. In 1922 he took charge of Marland Refining Co. operations and when Marland and Continental merged in 1929, Dr. Miller continued as vice president in charge of manufacturing. He will engage in refinery consulting work in the future.

Harold G. Osborn, manager of manufacturing, will assume full charge of Continental's eight refineries. He joined the Continental organization in the power division of the Ponca City refinery in 1921. He was made assistant manufacturing manager in 1927 and manager in 1935.

LOUIS E. HANSON has been made comptroller and Edward P. Fischer an assistant treasurer by Socony-Vacuum Oil Company, Inc. Mr. Hanson takes the position of comptroller vacated by the retirement of Arthur T. Roberts. Mr. Fischer succeeds to the vacancy created by the appointment of John F. Seal as treasurer.

LT. COL. ROBERT H. INGALLS, C. E., formerly Chief, Supply Division, North Atlantic Division, Corps of Engineers, has rejoined the Purchasing Department of the Standard Oil Company of New Jersey, with which he was associated for 13 years prior to his military service which began in 1941.

E. M. BUTTERWORTH has been elected president of American Overseas Petroleum Co. He succeeds E. A. Skinner, who has returned to Standard of California as a member of Vice-President J. H. MacGaregill's staff.

Butterworth joined Standard of California as a geologist in the Santa Maria area in California in 1917. Subsequently he worked in Alaska, Madagascar and the Dutch East Indies. In 1936 he became assistant manager of the foreign producing department. During the war, Butterworth spent two years on leave of absence from Standard as a special representative for PAW.

In July, 1944, he became a vice-president of American Overseas when the company was formed. American Overseas manages foreign exploration and development activities of companies jointly owned by Standard of California and The Texas Company, with the exception of their Arabian and Bahrein interests.

O. P. COTTRELL, a veteran research chemist and refinery executive, has been appointed manager of manufacturing and research for Alliance Oil Corporation. Mr. Cottrell was with Tide Water Associated for many years and more recently with The Texas Company. He has made many trips to Europe and Japan and has been interested in development of solvent refining processes. While with Tide Water, he was responsible for installation of the first solvent refining plant in the United States.

DR. JOSEPH PAYNTER HOLT, former associate professor of physiology at the University of Louisville, has joined the medical department of Standard Oil Company (New Jersey) as a specialist in toxiology. He will be responsible for original research in the biological effects of toxic substances.

Dr. Holt will also act as consultant and adviso. to the company committee, representing all phases of the company's operation, which is charged with elimination of potential hazards to workers.

With the establishment of this branch of its medical department, Jersey Standard becomes the first oil company to undertake its own work in this field. Previously, research has been conducted in outside institutions and laboratories.

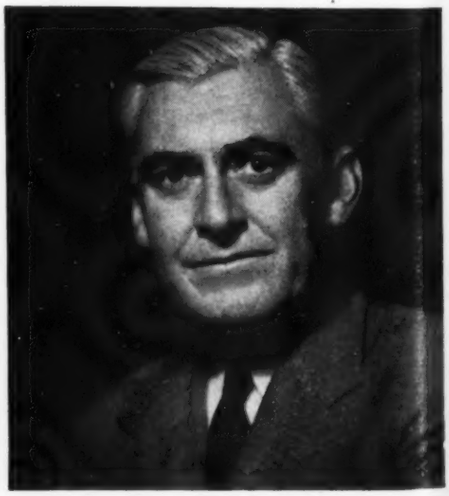
ROBERT S. HATCH has been appointed manager of the purchasing department of The Texas Company, succeeding Greer W. Orton, who has become assistant to President Harry T. Klein. Mr. Hatch has been with Texaco since 1927, and has been a member of the purchasing department since 1938.

Mr. Hatch was employed by The Texas Company in 1927 and served in the refining department until 1938, when he was tranferred to the purchasing department. He became assistant manager in 1943.

ROBERT P. RUSSELL, president of Standard Oil Development Company, and head of the central technical and research work of Standard Oil Company (N. J.) will receive the 1946 gold medal of the American Institute of Chemists at the May meeting of the organization.

Presentation of the medal will be in recognition of the development work carried on under Dr. Russell which included perfection of the fluid catalytic cracking process, synthesis of toluene from petroleum, development of a catalytic process for producing butadiene from petroleum. War work included cooperation in development of the M-1 mechanical smoke generator, the M-69 aerial incendiary bomb and the improved flame throwers which used jellied gasoline.

Robert P. Russell



JOHN JACOB BROWN, chairman of the boards of Foster Wheeler Corporation, and Foster Wheeler Ltd. of Canada, died recently at a New York hospital. He was 73. Mr. Brown was a native of Tyler, Texas, and entered business as a construction engineer in 1895. He became vice president of Wheeler Condenser and Engineering Co. in 1907 and president in 1918. He became chairman when the present company was formed through a merger. During World War I he was a member of the condenser committee of the War Industry Board.

RICHMOND PETROLEUM COMPANY of California has announced the election of G. E. Lindley as a director and vice-president of the company. He will be in charge of all marine operations. Richmond, a Standard of California subsidiary, is the management company for operations in Venezuela and Colombia.

R. E. FLIKKEMA, for twenty years manager of the Pittsburgh office for the Taylor Instrument Companies, has been transferred to Tulsa to take charge of that branch. With him is A. R. Wagner.

F. C. Fuzzard, who worked with Mr. Flikkema, several years, was made acting manager of the Pittsburgh territory. A. C. Mahana, of Rochester, is assisting Mr. Fuzzard in that territory.

RICHARD ROLLINS has been elected secretary of The Atlantic Refining Co. to succeed the late William M. O'Connor who died a short time ago. At the close of his service in World War I, Mr. Rollins joined Atlantic and was assigned to the Paris offices marketing operations. Later he was made general European representative.

In 1934 Mr. Rollins returned to Philadelphia to become assistant secretary of the company and director of public relations. He retains the public relations work in addition to assuming the duties of secretary. He also is secretary of a number of Atlantic subsidiaries.

Richard Rollins

Hanford Z. Hight

Hugh A. Neal

HANFORD Z. HIGHT has been appointed sales manager of Dresser Manufacturing Division, Bradford, Pa., it is announced by Hector P. Boncher, general manager. For the past three years Mr. Hight has served with the navy as an air combat intelligence officer. Prior to his navy service, Mr. Hight was a mid-west district manager of Dresser Manufacturing Division.

H. G. M. FISCHER and Edwin J. Gohr, formerly manager and associate manager of divisions of the Esso Laboratories, have been appointed assistant managers of the Research and Development Department of Standard Oil Development Company.

Consequent to the new appointments, five other promotions were made. A. P. Hewlett was made manager of the Process Division of the Esso Laboratories succeeding Mr. Fischer; F. W. Schumacher and R. M. Shepardson were appointed assistant managers; B. C. Belden succeeds Mr. Schumacher as laboratory director; O. W. Tyson replaces Mr. Gohr as associate manager of the Development Division of the Esso Laboratories.

DR. LESTER L. HIRST of Pittsburgh, Pa., a pioneer in American research on synthetic liquid fuels has been appointed acting chief of the new hydrogenation demonstration plant which the Bureau of Mines will establish at the Missouri Ordnance Works near Louisiana, Mo.

Other appointments to the plant staff include D. S. Taylor of Otis, Kansas, as chief of plant maintenance and J. A. Markovits of Pittsburgh, Pa., as second assistant to Dr. Hirst. Both of these men already were employees of the Bureau of Mines. Dr. Hirst has been assistant chief of the Bureau's synthetic liquid fuels Research and Development Division at Pittsburgh, working with Dr. Henry H. Storch, division chief, in the Bureau's laboratory-scale hydrogenation.

LT. COL. HUGH A. NEAL rejoins Phillips Petroleum Company, Bartlesville, Okla. assistant manager, Perco division, chemical products department, after over 5 years in the parachute field artillery. He commanded the artillery of the army's first parachute combat team going into Sicily and was wounded in Italy on May 31, 1944.

A. L. OWENS, recently appointed president of Standard Oil Company of Egypt, was formerly engaged in production activities in the Caribbean area. In 1939 he was transferred from Trinidad Oilfields Co. Ltd., to Standard Oil Co. of Venezuela and was made assistant manager at Caripito, in eastern Venezuela. From there he went to the Caracas office of the company as assistant manager. Following the consolidation of Standard Oil Co. of Venezuela with Creole Petroleum Corporation, Mr. Owens was made manager of the Maracaibo division, leaving that post to become executive head of the Egyptian subsidiary of Standard Oil Co. (N. J.)

SIDNEY GOLDIN, on military leave from Shell Oil Company, Inc. since August, 1943, has returned as assistant manager of the asphalt department. Mr. Goldin, who has been with the company since 1930, was New York division sales manager when he entered the Navy. He returned from Guam as officer in charge of petroleum supplies, with the rank of Lieutenant Commander.

EUGENE P. BOWLER of Bradford, Pa., who served as Lieutenant Commander in the U. S. Navy during the war, has joined the Pennsylvania Grade Crude Oil Association as field engineer in the production research department at Bradford, according to R. V. Hughes, director of the research program. Mr. Bowler was in charge of the Sloan & Zook Company oil laboratory at Bradford for several years before leaving to enter the Navy in 1941.

F. B. HAVERFIELD has been appointed manager of the natural gasoline and gas division of Continental Oil Company. He succeds R. A. Carter, who has resigned to join Stanolind Oil Co. at Tulsa.

Haverfield joined Continental as plant chemist, Big Lake Field, Texas, in 1929. He was made assistant superintendent of the gasoline department, with headquarters at Ponca City, in 1939, and was appointed assistant manager four years later. He will be succeeded by D. B. Edwards, asssitant to manager of the department since 1943. F. B. Willson, assistant process engineer, succeeds Edwards as assistant to manager.

ALVERD C. STUTSON has been appointed chief engineer of the technical division-industrial section of Socony-Vacuum Oil Company, Inc., succeeding W. G. G. Gordon, who has retired. Gerald J. Van Liew, staff engineer, has succeeded Mr. Stutson as assistant chief engineer. Mr. Stutson, who is considered an authority on power equipment operation and lubrication, devoted much of his time during the war to consulting on critical problems with the Navy and Maritime Commission.

ALEX J. DIEPENBROCK has joined Luis E. Kemnitzer and L. W. Richards, geologists and engineers, Los Angeles, forming the firm of Kemnitzer, Richards and Diepenbrock. Before his war service in the Navy, Mr. Diepenbrock was manager of production for The Petrol Corp. for several years.

PAUL W. ZUMBROOK has been appointed as manager of domestic lubricating oil sales of Sinclair Refining Co. From New York headquarters he will supervise the activities of the Sinclair automotive and industrial lubrication staffs, working closely with equipment manufacturers in the development of new lubricating oils. Mr. Zumbrook joined Sinclair at Chicago in 1916.

S. A. MONTGOMERY, manager of the Whiting, Ind., refinery of Standard Oil Co. (Indiana), has been appointed assistant general manager of manufacturing in the Chicago general offices. He will be succeeded by Dr. W. J. McGill, manager of Standard's Wood River, Ill., refinery, who originally joined the company at Whiting. Dr. G. F. Ordeman, assistant general superintendant at Whiting, will be promoted to succeed Dr. McGill and A. F. Endres, superintendent of the light oils division at Whiting, will be promoted to succeed Dr. Ordeman.

RALPH D. CURTIS has resigned from the Barnsdall Oil Company to join Earlougher Engineering of Tulsa as valuation—appraisal and pressure maintenance engineer. He was with Gulf Oil Corporation from 1929 to 1936 in the production and engineering departments on property evaluations, natural gasoline plants, unitization and reservoir studies. In 1936 he joined Barnsdall as proration and conservation engineer and in 1942 he was made Kansas production superintendent. In December 1942 he entered the Army in which he rose from Captain to Lieutenant-Colonel. He recently was awarded the Legion of Merit.

H. W. STRALEY, III, chairman of the AIME committee on geophysical education, has retired from government service in the FEA and is entering consulting work in oil and mining exploration. From Washington offices he will specialize in Appalachian, Atlantic seaboard and Caribbean areas.

R. J. HULL has been appointed sales manager of Cities Service Oil Company (Pa.) it is announced by J. A. Kelley, vice president in charge of marketing. Succeeding Mr. Hull as manager of the New York division is E. C. Mackay, former superintendent of operations for the division. J. E. Gately, Jr. moves up from New York division sales manager to the post of assistant division manager.

C. A. BEELS manager of the land division of The Carter Oil Company exploration department went to New York February 15 to become associated with the Standard Vacuum Oil Company. He has been with Carter for 13 years and has spent 10 years of that time in Tulsa. Previous to service here, he was stationed in Saginaw, Michigan, and Roswell, N. M.

He will be succeeded in Tulsa by N. Y. Ruth, who becomes manager of the exploration department's land division. Ruth, who started with Carter in June, 1927 at Duncan, Okla., has served in the geological, scouting, geophysical and land branches of the company. Since December, 1943, he has been manager of Carter's exploration work in the Northwest division, with headquarters at Billings, Mont.

E. F. BATTERSON, New York City, eastern sales manager of Continental Oil Company, has been appointed assistant to the president, it was announced by Dan Moran, president. He succeeds George D. Olds, who has resigned. Battson also assumes chairmanship of the advertising and manufacturing and sales committees. He joined Continental in 1922 and has held many sales and administrative positions with the company. Olds joined Continental in 1933 as assistant to the president. He will continue for a short time as president of Petroleum Chemicals, Inc. and Oil and Gas Research, Inc.

ALAN R. MARTIN has been appointed assistant to the general manager of marketing of Colonial Esso Marketers, a newly created position. He will concern himself with general marketing matters throughout Colonial Esso Marketers territory of 18 states and the District of Columbia. Mr Martin Joined the Standard Oil Co. of New Jersey ninteen years ago at the Bayonne refinery personnel office. In 1929 he was transferred to company headquarters as assistant in personnel and training. In November 1944 Mr. Martin was named assistant manager of the employee relations department.

Paul W. Zumbrook

R. J. Hull

Alan R. Martin

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International News and Notes

Mexican Oil Settlement

REPORTS have been persistent in Mexico City and recently have been echoed in dispatches from London that a basis has been arrived at for settlement of claims arising from expropriation of the properties of Mexican Eagle Oil Company. It is not anticipated, however, that an early completion of negotiations can be looked for. In fact, the date reputedly set for the rendering of a report by the evaluation committee is February 7, 1947 and final agreement might be much longer delayed. Eagle's holdings were larger than those of the American companies whose claims already have been adjusted. Moreover, the company is a member of the Royal Dutch-Shell group and the governments of both Britain and the Netherlands presumably will have a voice in the settlement.

U. S. Exports to Russia

SHIPMENTS of petroleum products from the United States to the Soviet Union from January 1 to September 1, 1945, covering approximately the final period of lend lease, amounted to 4,789,571 barrels valued at $39,381,000. Exports consisted mainly of avaiation fuel, 2,274,751 barrels; other gasoline, 1,013,045 barrels; and distillate fuels, 1,040,534 barrels.

China Plans Oil Program

GLEN M. RUBY and Arthur D. Small, respectively vice president and chief petroleum engineer of United Engineering Corporation, S. A. are on a trip to China in behalf of the National Resources Commission of China to review the possibilities for increasing the production of crude petroleum. They will visit many of the areas in China where petroleum has been produced and where geological conditions are known to be favorable for a possible development of production. A number of engineers have prepared reports on the petroleum possibilities of China during the war, among them M. J. Gavin and Dr. John L. Rich. Mr. Ruby and Mr. Small will review these reports and consult with Chinese engineers who have been responsible for the developmnt program undertaken to date. They will then recommend to the National Resources Commission an operating program with particular emphasis on exploratory work in favorable areas close to the centers of population.

Material Shortages Hit Argentina

THE effect of war-time shortages of materials is seen in the number of producing oil wells in Argentina as recently announced by Yacimientos Petroliferos Fiscales. In 1941 the number of producing wells in Argentina increased 275 to 3509; in 1942 the increase was 292; in 1943 only 88 new producing wells were added and in 1944 this was reduced to 21, bringing the national total to 3,913. On December 31, 1944 there were 2,499 Y.P.F. wells and 1414 wells owned by private enterprises.

Eighty-five percent of all Argentina's producing wells were in the Comodoro Rividavia field in 1944, the total there being 3332 compared with 301 in Plaza Huincul, 183 in Salta and 97 in Mandoza.

H. Gottwald

Active Equipment Market

A RAPIDLY expanding market in Venezuela for industrial goods is predicated by H. Gottwald, foreign sales executive of the Rockwell International Company, who recently returned from a market survey of the Venezuelan oil fields. He feels that the development can only be held back by a lack of understanding of the problems peculiar to operation in Venezuela.

"First of all," says Mr. Gottwald, "wage rates for all types of labor are very high, and living costs are correspondingly high. Petroleum companies are paying high concession prices for exploratory land. Transportation is expensive, not only to bring necessary equipment to Venezuela, but also to move it to field sites.

"Because of these inflationary conditions, operation is only feasible if large-scale produccan be maintained. If proration is imposed the oil companies will be in a difficult position because of the heavy costs and taxes. Nevertheless, they are pushing activities in order to prove up concessions within the time limit stipulated by their contracts."

Hungary's Field Russian Controlled

COMMENTING on a news dispatch reporting that the Russian Army had seized properties of a company affiliate in the Lispe Oil fields of Hungary, Frank W. Abrams, board chairman of Standard Oil Company (N. J.) explained that at no time since the entry of the United States into the war have the properties been under American control. They were taken over by the Hungarian government in December, 1941. In February 1945 the Russians took possession of the field and since then have directed all operations. Only recently have Standard officials been able to survey properties in Hungary, when a party of American management representatives and technicians obtained entry into Hungary through the efforts of the U. S. State Department.

"Prior to the war," Mr. Abrams stated, "oil was produced from the wells at Lispe at the highest rates possible without waste. Plans for developing the field called for saving the natural gas produced with the oil by recompressing it and returning it underground. Thus the gas helps to bring more oil to the surface and also is conserved and some day could be used for heating and other purposes if pipelines should be available to carry it to centers of consumption."

United Kingdom Production

PRODUCTION of oil from wells in the United Kingdom from 1939 to 1945 has been announced by Anglo-Iranian Oil Company Ltd., the only operating company, as follows:

Year	*Tons*
1939	3,145
1940	16,689
1941	29,992
1942	81,298
1943	112,760
1944	94,570
1945 (11 mos.)	66,163

Ecuadorian Test Abandoned

SHELL COMPANY OF ECUADOR LTD. has confirmed the abandonment of its Vuono No. 1 at 5300 feet as a dry hole. Much interest attached to the well as it was the first exploratory test on the company's 10 million hectare concession southeast of Quito and the first well to be drilled in the great Llanos region east of the Andes in Ecuador. The well was started in August 1944 and its drilling presented unusual problem as most of the equipment used had to be brought in by plane over the mountains owing to lank of other transportation facilities. Other tests are scheduled in the area at locations that have been selected.

TWO PROVED BRITISH PRODUCTS FOR THE PETROLEUM INDUSTRY

Klinger Reflex Level Indicators withstand pressures up to 1,200 lbs. per square inch, and temperatures up to 800° F. They can be built up to any desired length, and are suitable for high-pressure stills and cracking plant, for reaction chambers and for all purposes where variations of temperature and pressure are severe. All component parts are standardised: Klinger gauges are easily maintained or replaced.

"Klingerit," the universal compressed asbestos sheet packing (high pressure jointing) is available in sheets up to 80″ x 240″ in area, and in thicknesses from .008″ to ¼″. Suitable for use on all modern high-pressure plants — oil, chemical and industrial—it will withstand working pressures of 5,000 lbs. per square inch and temperatures of 900° F. Impervious to steam, gases, chemicals and oils, "Klingerit" can also be supplied as ready-cut gaskets.

Other Klinger products include: Sleeve-packed cocks and valves of many types, asbestos packing materials and level gauges for a wide field of engineering purposes.

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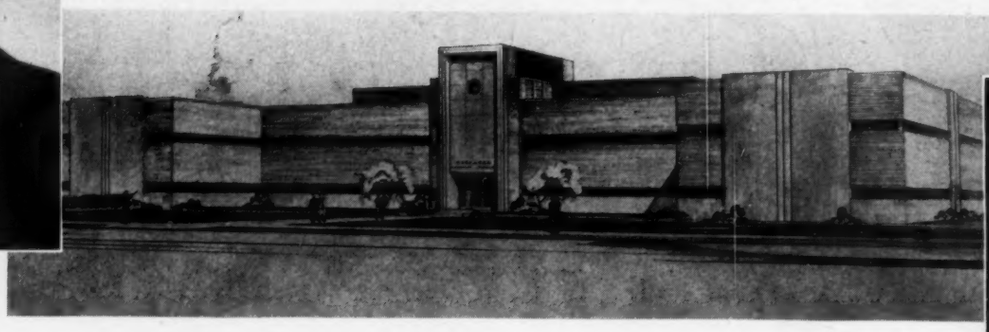
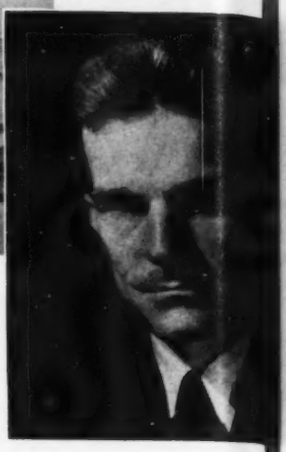
SHELL EXPANDS RESEARCH ACTIVITIES

Dr. Harold Gershinowitz



↑ Elevation of Research Laboratory.



Dr. M. King Hubbert

SHELL OIL COMPANY INC. has announced plans for a broad expansion of its basic and applied research in physics, chemistry and geology. To facilitate these activities it is constructing a new exploration and production research laboratory at Houston, Texas, where work in these fields will be consolidated in a new Division of Exploration and Production Research.

Head of the new division, as director, is Dr. Harold Gershinowitz formerly Shell's director of manufacturing research, New York. A native of Brooklyn, N. Y., Dr. Gershinowitz received his B. S. degree from the College of the City of New York in 1931, and his M. A. and Ph.D. degrees from Harvard University in 1932 and 1934. Awarded a Parker Traveling Fellowship by Harvard, he spent the following year at Princeton University. Subsequently, he became research associate to Prof. H. C. Urey at Columbia University and to Professors E. Bright Wilson, Jr., and G. B. Kistiakowsky at Harvard. The author of many papers dealing in reaction kinetics, quantum theory, statistical mechanics, and spectroscopy, Dr. Gershinowitz joined Shell in St. Louis in 1938 as research technologist. Two years later he was placed in charge of the Houston refinery research laboratory, and in 1941 was made its research director. Transferred to New York in the fall of 1942, he became research director for the company's Manufacturing Department and was responsible for research activities at both the Houston and Wood River research laboratories.

Assisting him as the associate director of research for exploration is Dr. M. King Hubbert, an outstanding authority on the physics of terrestrial phenomena, and the theory of scale models. Dr. Hubbert joined Shell in 1943 after a distinguished career as a geologist and geophysicist. Forty years old, Dr. Hubbert was born in San Saba County, Texas, and received his technical education at the University of Chicago, gaining his B.S., M.S., and Ph.D., in 1926, 1928 and 1937. He started his career as a geologist with Amerada Petroleum Corporation in 1928. From 1930 to 1940, he was a lecturer in geology and geophysics at Columbia University. At various times during this period he served as geophysicist for the Illinois Geological Survey and as associate geologist with the U. S. Geological Survey. In 1942 and 1943 he was attached to the Office of Economic Warfare in Washington.

The activity of this new research laboratory is based primarily on the principle that problems in exploration and production are fundamentally related, and that research in each field cannot be conducted independently of the other. The new laboratory proposes to carry on an integrated research program exploring each problem by the use of physics, chemistry, geology, and related engineering sciences. Under the director of research and his associates, liasion with Shell's operating departments will be maintained as well as the correlation of research in the physical, chemical, and geological departments. It is believed that this flexible organizational structure will eliminate traditional barriers between these basic sciences and insure that research into petroleum exploration and production be conducted with cooperation and efficiency. While the ultimate objective of the new laboratory's research program will be to develop new or improved methods of finding oil and of getting it out of the ground after its discovery, it is recognized that a considerable amount of long-range or "fundamental" research must also be carried on in each of the basic sciences to improve the "tools" with which the new laboratory will work.

In addition to its research activities, the new division of exploration and production research will function as an instruction center for training personnel in new techniques and methods developed by the laboratory. Exploration and production men will be thoroughly acquainted with new developments and will carry them into practical application in the field.

The large, air-conditioned laboratory building soon to be under construction will be fully equipped with the most modern facilities and apparatus and will cost nearly a million dollars. The Austin Company will design, engineer, and construct the building.

A two-story building which will cover 40,000 square feet, the new laboratory has been designed so as to permit maximum operating flexibility. The dividing walls within the building itself are of glazed hollow tile which are semimovable, bear no structural load, and may be easily knocked out and replaced to allow enlarging of laboratory rooms at will. Ample provisions have been made for a first-aid room, for locker and shower rooms, and for women's rest rooms. A cafeteria for 75 persons has been included, and as an added feature an outdoor dining terrace. A library and two conference rooms will provide facilities for study and discussions.

The building has been designed to provide facilities for a total staff of 130 on the basis of an optimum average working space of 200 square feet per man, with the intention of eventually expanding the staff to 155 with approximately 150 square feet per man. The plot, plan, and design are such the working space may eventually be doubled.

To provide maximum flexibility in the research areas of the laboratory building, an effort has been made to build them of standard units which can serve equally well for chemical, physical, or geological work. One unit is designed for two research projects, employing on the average one senior man, two junior men, and one technician. This unit has approximately 700 square feet of floor space. Another, a laboratory office unit, with 210 square feet of floor space, may be used as a combination office and laboratory for senior research man.

The design and manufacture of special instruments will also be a function of the new division. This will be done in an existing air-conditioned building adjacent to the new laboratory, employing an additional 75 persons.

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INTENSIVE DRILLING AT RANGELY

By Clark F. Barb *

THE most interesting and important development in Colorado during the past year has been the rather intensive drilling in the Rangely field without a dry hole to date. This field is in the northwestern corner of the state, about ten miles from the Utah line and produces from the Weber formation of Pennsylvanian age at depths of 5,700 to 6,500 feet. The surface elevation is 5,200 feet along the White River at the south edge of the field.

At the end of January 1946, there were 33 producing (flowing) wells drilled on an 80 acre spacing although many interior locations are not yet drilled. The proved acreage is on the order of 21,000 acres. The bottom hole pressure is nearly 2,750 psi and all wells have come in flowing. Potentials range from 200 or 300 to as high as 1,000 barrels daily but the wells are choked down to 350 barrels or less. Gas oil ratios generally are low and on the order of 200 to 400 cubic feet per barrel. No water has been found in the producing zone.

All wells are drilled with rotary rigs and recently the use of oil-base mud has become common to prevent water locking of the producing formation in which the permeabilities are generally very low. The oil is about 34 API gravity and has a reservoir viscosity of one to two centipoises.

The oil is moved from the field through a ten inch pipeline to Wamsutter, Wyoming about 120 miles distant. The oil is put through in one jump from the pump station at the field. The present capacity of the line is 20,000 barrels daily which may be increased to 30,000 barrels per day by installing a booster station. Wells cost from $125,000 to $140,000 each and the operations are controlled chiefly by major oil companies. Recently the operators established a field committee and an engineering committee for cooperative work. The purpose is to gather data and operate the field as efficiently as possible. All operators have representatives on the committees.

Other interesting developments were the drilling of two deep (for this region) tests in western Colorado. One test was the Divide Creek well in Section 36, T 8S, R 91W in Mesa County. This well was drilled to a depth of 10,805 feet in 1939 by the Continental Oil Company, and was deepened to a depth of 11,942 feet in 1945 by California, Continental and Amerada companies. The test was abandoned below the Entrada formation of Jurassic age as all formations were hard, tight and dry. The second deep test is being drilled by the Texas Company in the Wilson Creek field in Moffat County. It has been carried to a depth of 12,702 feet and is now being tested. This well reached the Parting Quartzite formation of Cambrian age.

A pressure maintenance operation which is unique and possibly without parallel anywhere in the world is being run by the Continental Oil Company in the McCallum Dome field in Jackson County in northern Colorado. This is the famous "ice cream" field which was discovered many years ago and which produced a mixture of frozen oil and carbon dioxide. The carbon dioxide is now being recycled for pressure maintenance in the field. Very careful control of pressures and temperatures is necessary. The operation seems to be working successfully.

Wildcat drilling all over the state has been active but no important strikes were made during 1945. Interest is still keen and leasing is fairly active although many blocks have been taken and are off the free list.

An interesting move was made by the state legislature when it appropriated money for a two-year program in industrial research, starting July 1, 1945. Part of the appropriation was allocated to the Colorado School of Mines and the money is being used in petroleum production projects. One project involved the collection of type well logs with an index map. This was published in January 1946. Another project is the collection, cataloging and indexing of well samples and cores. This project is well under way and includes wells from adjoining states as well as Colorado. Samples from some 1,400 are cataloged. This project is a continuation of one started by the geology department some years ago.

The average daily production of the state increased from 9,200 barrels per day in January 1945 to 21,679 barrels per day in January 1946. This increase was due chiefly to the developments at Rangely. The average daily production per well increased from 50 barrels to 90 barrels in the same period.

*Prof. of Petroleum Eng. at the Colorado School of Mines.

New Petroleum Register

THE 24th edition of the Petroleum Register, which is now ready for delivery, contains 600 pages of data regarding active oil companies throughout the world. In the case of the most important companies the Register gives their history, capital and corporate structures, affiliations and subsidiaries. Concessions, properties, manufacturing, transportation, and distributing facilities are recited.

The new edition contains more than the normal number of changes because no Register was published in 1944 in view of the war-time paper shortage. Special attention has been given to the South American section.

Orders may be placed with World Petroleum, 2 West 45th St., New York 19, N. Y. Price postpaid is $10 in the United States and $12 elsewhere throughout the world.

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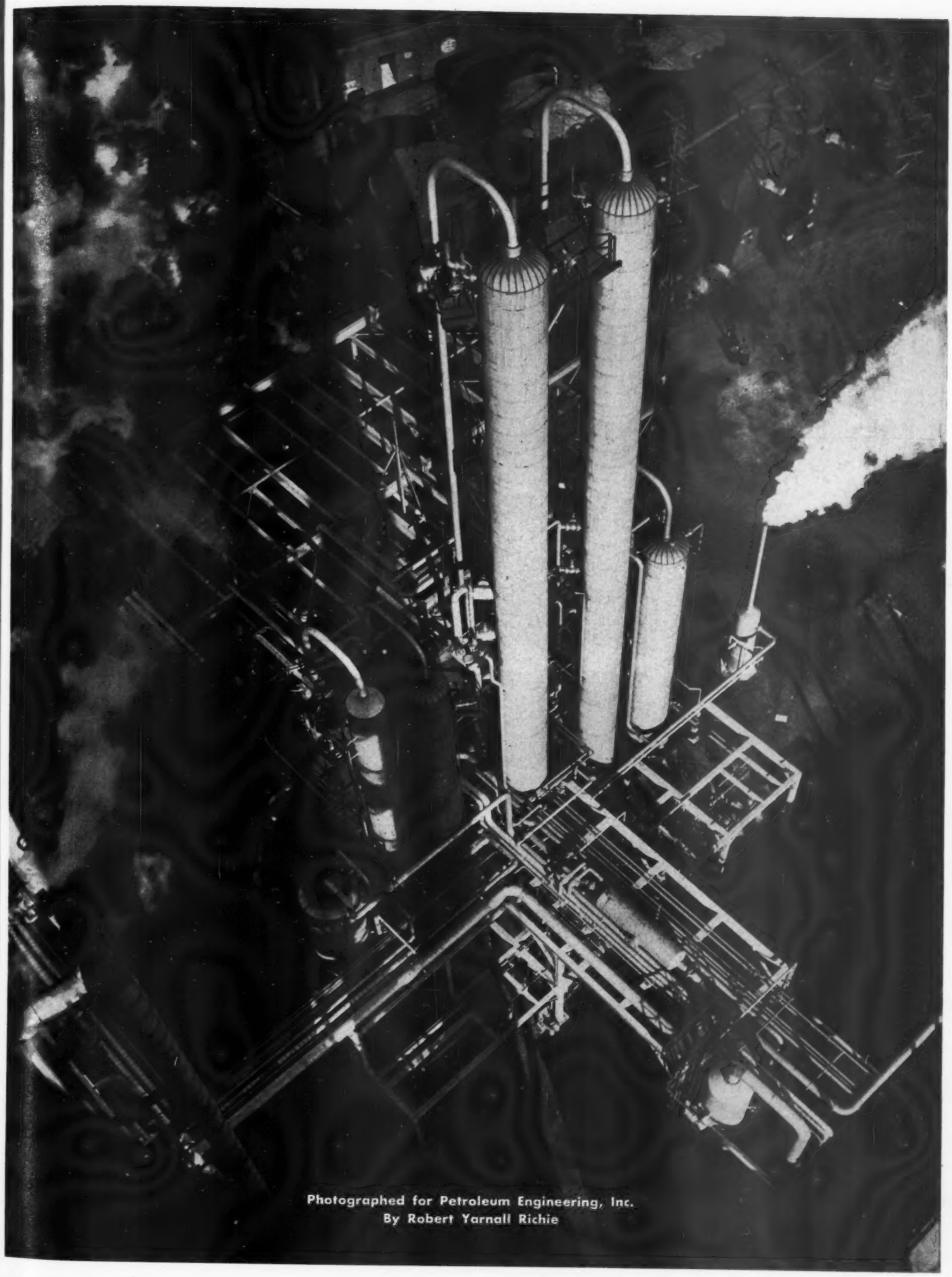

Photographed for Petroleum Engineering, Inc.
By Robert Yarnall Richie

IHC Buys Buick Plant

INTERNATIONAL HARVESTER COMPANY has purchased the Melrose Park, Chicago, works of Buick which were used during the war to build aircraft engines. The plan gives International two million square feet of floor area for the industrial power division.

The new plant will be used for the production of the company's present line of gasoline and diesel engines and, in addition, two new and larger diesels of 100 and 200 hp. range and a large crawler tractor with 130 drawbar hp. weighting about 36,000 pounds.

International paid $13,750,000 for the plant and land which cost the government 17,286,000 during the war.

Continental Adds New Tanker

THE S. S. Lake Charles, new flagship of Continental Oil Company's tanker fleet launched recently at the Bethlehem-Sparrows Point Shipyards, Sparrows Point, Maryland, is one of the first completed since the war's end. It is one of the fastest tankers afloat with a speed of 15 knots. The ship has a cargo capacity of 134,000 barrels and storage space for 11,650 barrels for her own fuel oil. The $3 million ship is the fifth unit in the Continental fleet.

Death of Joseph Gordon

JOSEPH GORDON, petroleum consultant, died recently as a result of an emergency operation at Stamford, Conn. Mr. Gordon opened a consulting office in New York in 1944 after spending two years as chief of the economics and supply section of the PAW production department. Before the war he was a specialist in oil securities.

CAPTAIN F. V. LOWDEN has been named veterans' coordinator of Standard Oil Company (New Jersey) and its affiliates. He will be responsible for implementing the company's policy of reinstatement of returned veteran employees. A member of the legal department of the company since 1920, Captain Lowden returns after 42 months in the U. S. Coast Guard where he was in charge of port security for the Third Naval District. He is a veteran of World War I in which he served overseas as a major in the field artillery.

JOHN F. BRICKER, recently chief scout of Humble Oil & Refining Company, has been appointed Assistant Division Landman in East Texas and will be stationed at Tyler.

David C. Fransen, recently returned from military service, has been named Chief Scout to succeed Mr. Bricker. Captain Fransen was an infantry officer who saw active service as a company commander in the Asiatic Pacific Theater. He holds the Purple Heart and a Presidential Unit Citation.

FRANKLIN COURTNEY ELLIS, formerly head of the public information department for Eastman Kodak, has joined the public relations staff of Standard Oil Company (Indiana), as assistant director.

Standard has also appointed John Canning as press representative in recognition of achievements in ten years as an assistant in public relations.

GOV. ROBERT S. KERR of Oklahoma, has been elected chairman of the Interstate Oil Compact Commission for the current year. Hiram M. Dow of New Mexico is first vice chairman and Warwick M. Downing of Colorado second vice chairman, Earl Foster was reappointed Secretary.

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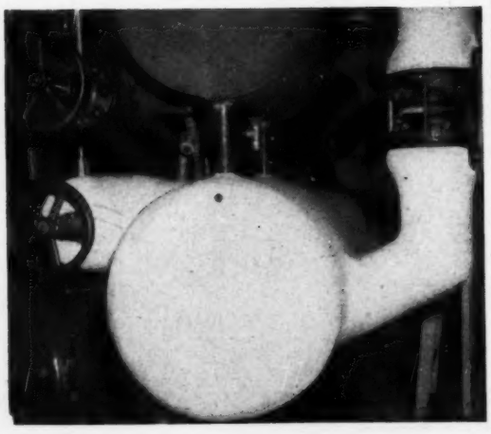

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Drilling For Oil in North Carolina

The record of drilling for oil in North Carolina up to the present date lists only two attempts. The first was made by the Coastal Plains Oil Company (now Tidewater Petroleum & Gas Co.) who put down a well near Morehead City; this well penetrated to the basement complex (granite) and was abandoned. It is understood that this company intends to drill six more wells on lands leased from the state in the southeastern part of the state. The first of these six wells will be located in the Holly Shelber area in Pender County.

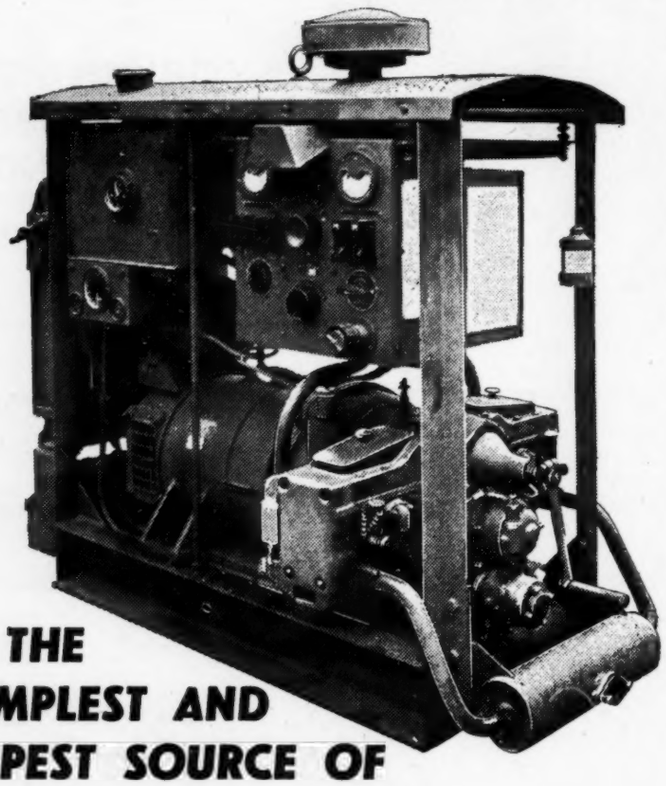
The only other well that has gotten under way is the Standard Oil Company's (N. J.) Hatteras Light No. 1 which is being drilled on Cape Hatteras and at present writing is now down beyond 4000 feet. The drilling is being done by Noble Drilling Company. Until recently hole was being made at the rate of 1000 feet a week; for a time the rate was slowed by a thick bed of pyrite. No other reports of progress have been given out.

Various oil companies are interested in the oil possibilities of North Carolina, particularly in the Albermarle region and with special reference to Pasquotank and Dore counties. The Standard Oil Co. (N. J.) is understood to have 23,409 acres around Buxton, the Gulf Oil Refining Company has 22,116 acres in the Newland section, The Smith Petroleum Co. has 12,827 and the Sun Oil Co. 435 acres. The Sinclair Oil Co. is also said to be interested.

Aside from general geological conditions learned from the surface, the tangible evidence of oil possibilities appears to be limited to the occurrence of what are thought to be domal structures along the coast. Considerable geophysical exploration has been done by Standard Oil Co. (N. J.) which also holds a lease from the state on submerged coastal waters, including a good portion of Roanoke Island and the Banks as far as Hatteras Inlet. According to local newspapers the above mentioned companies have spent half a million dollars on seismographic explorations and are preparing to spend a million more in areas where the Department of Conservation and Development indicates that underwater explosions will not be too damaging to fish.

Sinclair to Enlarge Research

SINCLAIR OIL CORPORATION has completed plans for the erection of new research and development laboratories at Harvey, Ill., in the Chicago area. The new plant will employ about twice as many persons as the present laboratories at the East Chicago refinery. Technical and professional staff will number about 550. Site of the new laboratories will be close enough to East Chicago so that present employees may retain their present homes.



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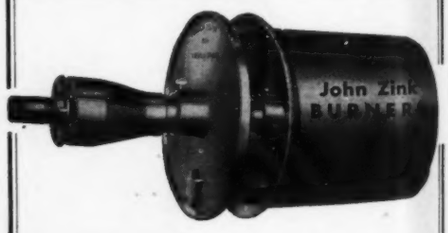

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Organizes Export Company

DAVID L. GORDON and W. C. Hillebrand, Jr., have associated with Anchor Petroleum Company, Tulsa in organizing Anchor Oil Company, with headquarters at Houston. The new company will handle world-wide distribution of all petroleum products, including liquified petroleum gas.

Gordon entered the oil business in 1938 as vice president and general manager of Refiners Export Company. In 1942 he became Gulf Coast representative for Anchor Petroleum Company, and in 1945 became a vice president of that company.

Hillebrand joined the sales department of Galena-Signal Oil Company of Texas in 1921, and subsequently has held sales positions with Crown Central Petroleum Corporation, Deepwater Oil Refineries, and Maritime Oil Company.

Represents Wyatt in New England

J. F. BECHTLE has been appointed New England representative of Wyatt Metal & Boiler Works with headquarters in New York City.

Mr. Bechtle was employed by the M. W. Kellogg Company for a number of years in the metallurgical and research division developing arc welding procedure methods beginning with the development of welding rod coating, designing and installing automatic welding machinery and in development work in the low and higher alloys, as well as solid alloys. He also worked in the estimating and general engineering division, and in managing and executive capacities. Mr. Bechtle left the Kellog Company to become assistant general manager for the Standard Steel Company of California.

New Subsidiary Organized

STANDARD Oil Company of California has organized a new subsidiary, California Oil Company, to market on the East Coast. Bulk storage and terminal facilities have been leased from Barber Asphalt Company at Barber, New Jersey. From this marine terminal gasoline will be barged to New York, New Jersey, Connecticut and Rhode Island points.

California Oil Company will market either branded or unbranded regular and premium grades of gasoline to the jobbing trade.

Officers of the new marketing subsidiary are E. W. Endter, president; E. H. Todd, C. J. Moody, H. C. Teasdel and J. T. Deane, vice presidents; and H. H. Brereton, Secretary.

HOWARD M. HERRON has been elected chairman of the board and chairman of the executive committee of the Bahrein Petroleum Co., Ltd. and of the California Texas Oil Co. Ltd. Mr. Herron has been president of these companies since their organization in 1936. Previously he was with The Texas Company.

William H. Pinckard, vice president and director of the companies since 1940, was elected president to succeed Mr. Herron. Mr. Pinckard was managing director for the companies in various countries including China, the Philippines and India before his election as vice president.

B. W. Letcher of San Francisco, vice president and secretary of Standard Oil Co. of California, was elected a director of both companies. E. A. Beverley was elected a vice president of California Texas Oil Co., Ltd.

A. J. KERR, formerly general sales manager, has been elected vice president of sales of the Rockwell Manufacturing Company, Pittsburgh. Mr. Kerr has been associated with the company for more than 20 years. His early career was as Tulsa district manager for Pittsburgh Equitable Meter and Nordstrom Valve companies, now divisions of the Rockwell.

Joins Russell Ostrander

G. L. VAN DER BOOM, formerly advertising manager of Southwest Welding & Manufacturing Company, Alhambra, California, has joined Russell P. Ostrander, Advertising, in the capacity of account executive. Mr. Van der Boom has over ten years experience in the sales and advertising divisions of industrial equipment concerns. His addition to the Ostrander staff will expand that agency's facilities in the industrial advertising field.

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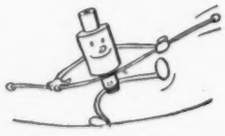

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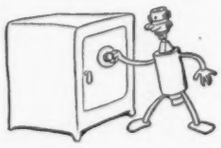

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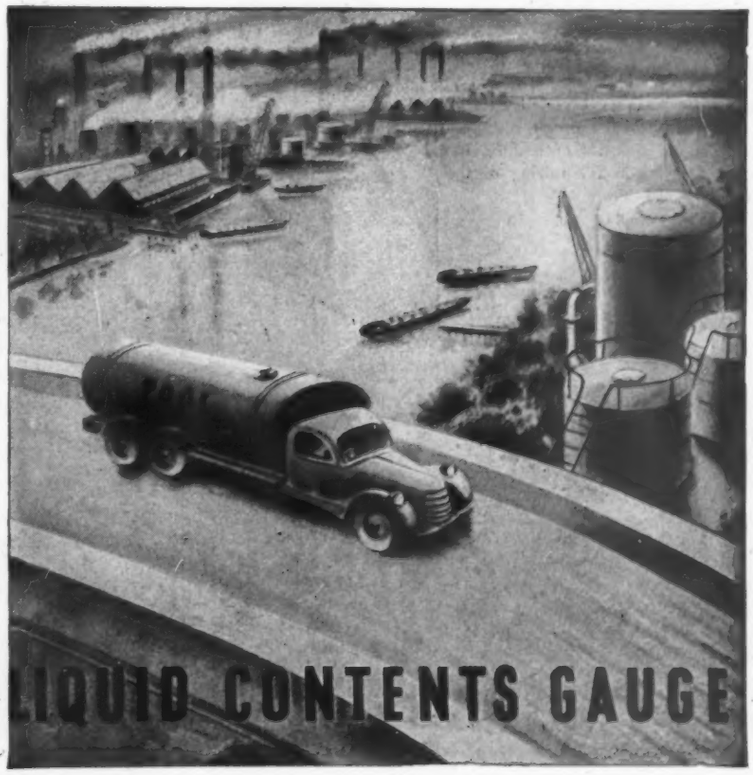

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Conversion of Dry Natural Gas to Liquid Fuels

(*Continued from page 49*)

addition there remained about 1200 cubic feet of gas containing 710 cubic feet of methane, 440 cubic feet of hydrogen, and about 25 cubic feet each of ethylene and acetylene. This residue gas was shown to have a calorific value of 775 gross BTU per cubic foot at 60 F and 30 inches of mercury. In these and many other investigations, it was shown that both the reaction temperature (1832-2192 F) and the flow rates were very critical for the production of liquid products in lieu of carbon and hydrogen from methane.

Although this method of conversion at present gives yields considerably lower than those obtained by the Fischer-Tropsch process, it has one advantage, in the event that yields are improved and costs reduced, namely, that the conversion requires only one step.

Other methods of utilizing dry natural gas for the production of liquid fuels may be mentioned briefly as follows: a) Direct high temperature and high pressure methanation of tars or oils; b) Interaction of methane and carbon monoxide at high pressures; c) Oxidative condensation of methane according to the following equation: $nCH_4 + \frac{1}{2}\, nO_2 — (CH_2)n + nH_2O$. d) Conversion of methane by means of the electric arc. The amount of published information regarding these is too small to appraise them fully. At present, they have been investigated only on a laboratory scale and are of academic interest only, but potentially they could become important industrial and should not be overlooked.

Conclusions

In conclusion, it may be stated that developments on the conversion of natural gas to liquid fuels are now in about the following position:

I. A few years ago, the conversion of dry natural gas by the Fischer-Tropsch route was an uneconomic process. Today, it has reached the point where large scale operations are being currently planned by private industry.

II. Private industry has developed many large scale processes for the conversion of the heavier constituents of natural gas to liquid fuels, and is making rapid progress in the conversion of natural gas to liquid fuels along the lines of the most economic processes.

III. Knowledge gained in the conversion of natural gas by the Fischer-Tropsch route will be directly applicable to the longer range projects looking toward the use of coal as a raw material.

It is too early to state what processes for natural gas conversion to liquid fuels will ultimately prove to be generally feasible economically. It is certain, however, that any future processes which may be selected will depend on many local conditions and will require the free interplay of all the various factors involved.

Acknowledgment

The author is very much indebted to Dr. Alfred Clark of the Research Department of Phillips Petroleum Company. Acknowledgment is also made of helpful suggestions received from numerous others.

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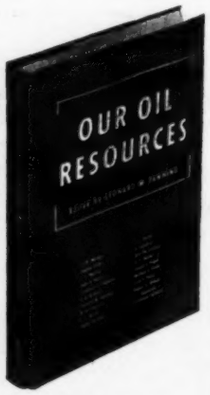

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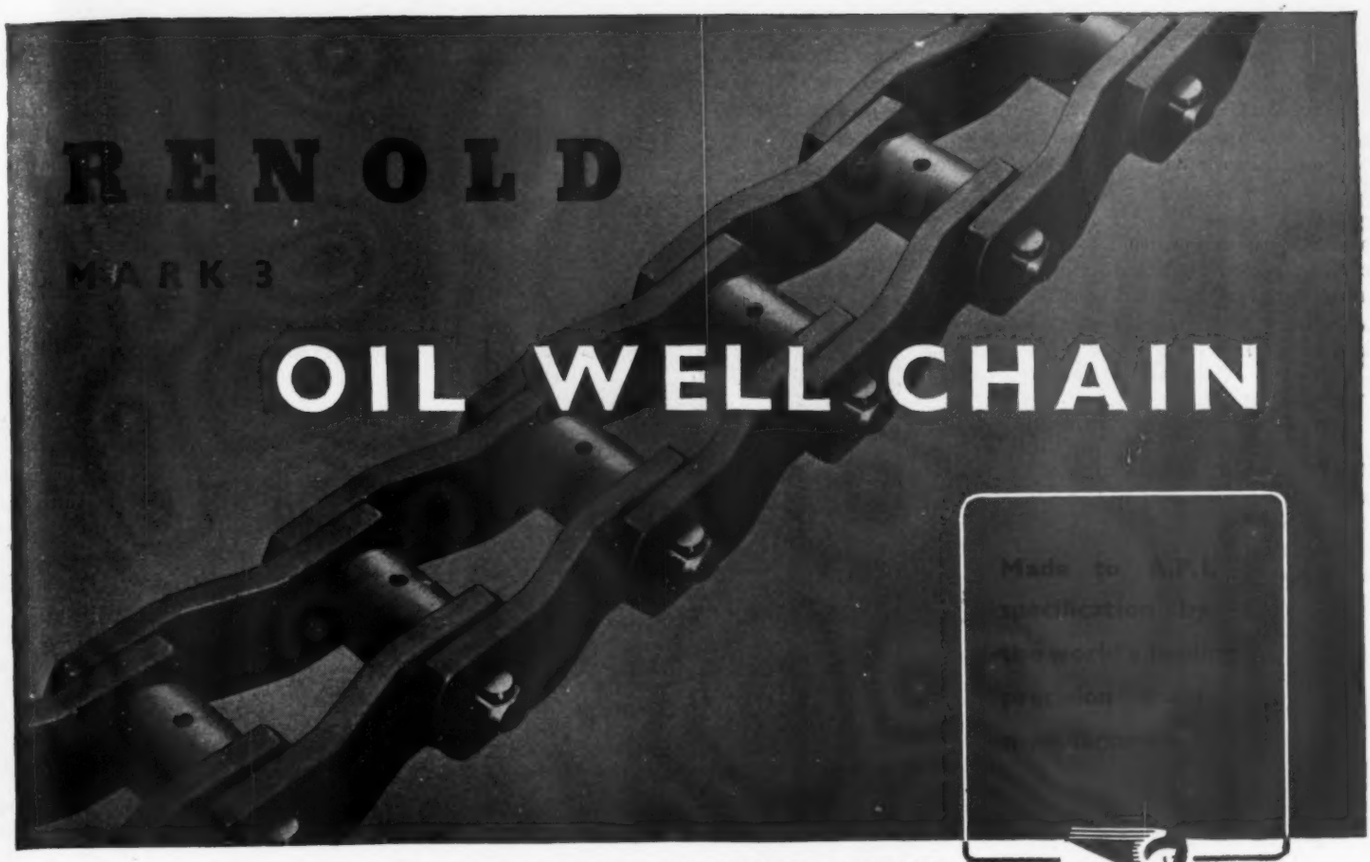

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Ballagh Elected President

J. C. BALLAGH has been elected president of Patterson-Ballagh Corp. He will continue in charge of sales promotion and development which he has directed since the company's inception in 1927.

Jack Ballagh is well-known throughout the oil world as a pioneer of the rubber drill pipe and casing protector, and also for his active development of many rubber oil field specialties during the past 18 years.

Joins G. M. Diesel Oil Field Staff

ARCH F. CAMPBELL, manager of the petroleum industry sales office of General Motors Detroit Diesel Engine Division, has announced the appointment of King D. Boyd as district manager in the Gulf Coast region. Mr. Boyd, a mechanical engineering graduate of the University of Oklahoma, will be located in Houston. He has been in the Navy for the past three years.

Gas Research Undertaken

STEARNS-ROGER MANUFACTURING COMPANY of Denver, is sponsoring a research program at the Engineering Experiment Station of the University of Colorado. Methods of reducing moisture content of natural gas to prevent high pressure line freeze-ups and other problems in the field of petroleum engineering will be undertaken.

W. I. ("IKE") WEST has been transferred from Houston, Texas to Mid-Continent Supply Company's division offices in the Petroleum Building, Midland, Texas, as division manager of the West Texas-New Mexico territory.

G. Wesley Gates

G. WESLEY GATES has been appointed as container sales manager in New England and upper New York State for Rheem Manufacturing Company it was announced by George W. Knight, sales manager, eastern container division. Mr. Gates comes from three years experience with Rheem in the military sales department at Washington, D. C. He will make his headquarters in the Park Square building at Boston.

AL PRANGER (Major, CWS, Inactive) has returned to active duty as sales manager of the Guiberson Corporation after three years with the Armed Forces. He will direct the sales of Guiberson oil field tools, domestic oil heaters, steel cabinets, sheet metal products and molded rubber products.

For seven years, prior to going into the Army, Mr. Pranger served as chief engineer and sales manager. A graduate mechanical engineer of Amsterdam, Holland, he has had many years experience in the petroleum industry.

Forms Export Company

BUFFALO BOLT CO., North Tonawanda, N. Y., has incorporated Buffalo International Corp. to handle overseas selling for the parent company and manufacturing subsidiaries including the S. M. Jones Co., Toledo, Ohio, manufacturers of sucker and pull rods. Headquarters for Buffalo International Corporation and J. C. Walker, president, will be at 50 Church Street, New York City.

Marsteller Heads Rockwell Advertising

WM. A. MARSTELLER has been appointed general advertising manager of Rockwell Manufacturing Co., Pittsburgh. He will coordinate activities of the various subsidiaries. Mr. Marsteller has been vice president in charge of sales, advertising and industrial relations of Edward Valves, Inc., East Chicago, Ind., a subsidiary.

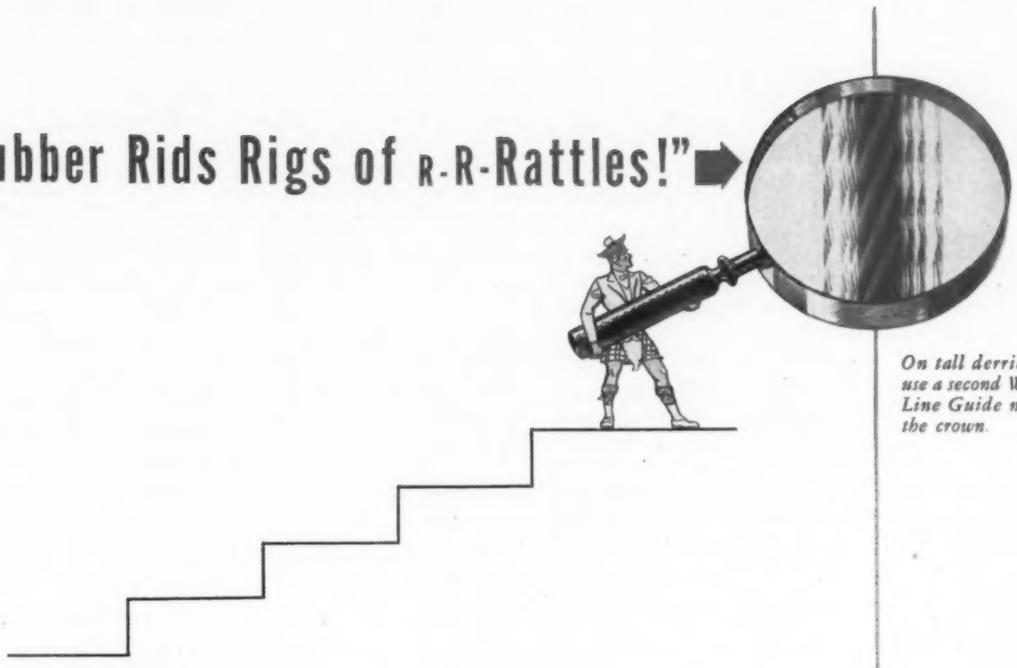
WEIR

HEAT EXCHANGE EQUIPMENT

Heat Exchangers for all duties. Crude-to-Residue Exchangers, Side Stream Exchangers, Oil Coolers, etc. Vapour Condensers for vacuum, topping or cracking plants. Final Condensers (water circulated) and Partial Condenser (circulated with incoming crude). Weir Refinery Equipment includes Oil Pumps for all duties, Steam Ejectors for Vacuum Stills, and all auxiliaries for Feed pumping and Feed heating. Write for Catalogue Section 8 "Weir Pumps for the Oil Industry" and Publication No. 38 "Weir Power Plant Auxiliaries."

G. & J. WEIR LTD.
CATHCART : GLASGOW

"Rubber Rids Rigs of R-R-Rattles!"



On tall derricks, use a second Wire Line Guide near the crown.

R-R-Rattles Ruin Rigs

R-R-Rattles result from vibration. Vibration murders metal. Like a thief in the night, it sneaks into the noise of drilling so naturally, we don't realize its danger. Yet, next to corrosion, vibration is one of the worst problems the operator has. You can see this principle at work when you bend a piece of wire back and forth in your hands until it gets hot, crystallizes and breaks. Vibration of your wire line bends the metal a hundred times faster than you can bend that piece of wire. You'll see what we mean if you'll watch the traveling wave in your wire line, for there's a real vibrating rattler at your most critical point.

PATTERSON-BALLAGH WIRELINE GUIDES . . .

are the life guards of your Wire Line, for they dampen this ruinous vibration and protect your line continuously. They iron out the traveling wave, spool line steadily and evenly onto the drum without kinking and cross-back tangles, speed up safe line spooling, and increase life of line 10 to 50 percent. Easy to hang, they are balanced for all types of derricks, simple to maintain, and automatic in operation. Line whip vanishes. Even a Scotsman would buy a Patterson-Ballagh Wire Line Guide to smooth the R-R-R-R out of his line and to save wear-r-r and tear-r-r.

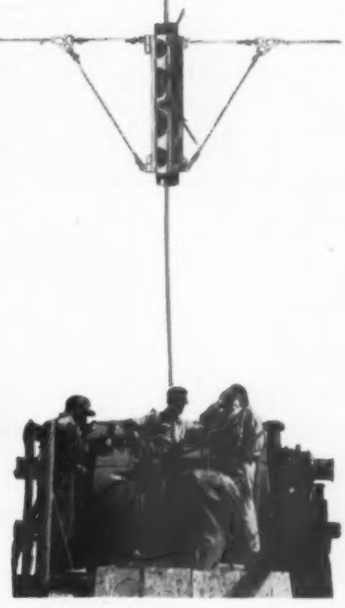
Our new fibre reinforced PBX Special Rubber Refills are made to stand wear and tear. They have been TIME-TESTED in the field, which is your positive assurance of long life.

Specify **PATTERSON-BALLAGH**

"Best Bet Yet"

WIRE LINE GUIDES

Main Office—1900 E. 65th St. Los Angeles 1 • 1506 Maury St. Houston 10 • 92 Liberty St. New York 6 • 210 Post Street San Francisco 8



"Joe" Eustice Heads Norris

J. H. "JOE" EUSTICE has been elected president of W. C. Norris Manufacturer, Inc. of Tulsa, to succeed the late Don S. Bowers. The election culminates 35 years of service to the company.

Mr. Eustice started with Norris when he was 11 years old working after school and in vacations. He worked in the plant, as bookkeeper and salesman. In 1936 he was made sales manager and in 1943 general manager.

Export Manager Named

W. A. FINN has been appointed export manager of Worthington Pump and Machinery Corporation having just been released from the U. S. Navy. He succeeds George Gellhorn who has resigned to become general manager of C. E. Halaby, one of Worthington's industrial machinery dealers in Colombia.

CHARLES D. HAWLEY has been appointed assistant to the general manager of Ethyl Corporation research laboratories at Detroit. John B. Taylor, Jr. has been named to suceed Mr. Hawley as assistant director of engineering research. Both appointments, as well as those of Earl Bartholomew a general manager of research laboratories, John B. Macauley as director of engineering research, and Robert V. Korley as director or aeronautical reseach announced recently, are part of a reorganization plan designed to increase the effectiveness of Ethyl's research laboratories in their postwar cooperative research with the petroleum and automotive industries.

Mr. Hawley taught mechanical engineering at Harvard before joining Ethyl in 1927 as an engineer in the Yonkers, N. Y. laboratories. When the laboratories were moved to Detroit a year later he became assistant director of engineering research.

Mr. Taylor became associated with Ethyl fifteen years ago as an engineer with the Baltimore division and since 1939 has been a member of the staff of the engineering research laboratories.

J. H. (JACK) SEMBOWER, who returned to Shell Oil Company in December after three years' service with U. S. Navy, has been appointed manager of the personnel and industrial relations department in Shell's Texas-Gulf area. A lieutenant in the Navy, Sembower spent 21 months in combat, seeing action at New Guinea, Pelelieu and elsewhere in the South Pacific. He was awarded the Bronze Star, Presidential Unit Citation, the Asiatic Pacific ribbon with three combat stars and the American Theater ribbon.

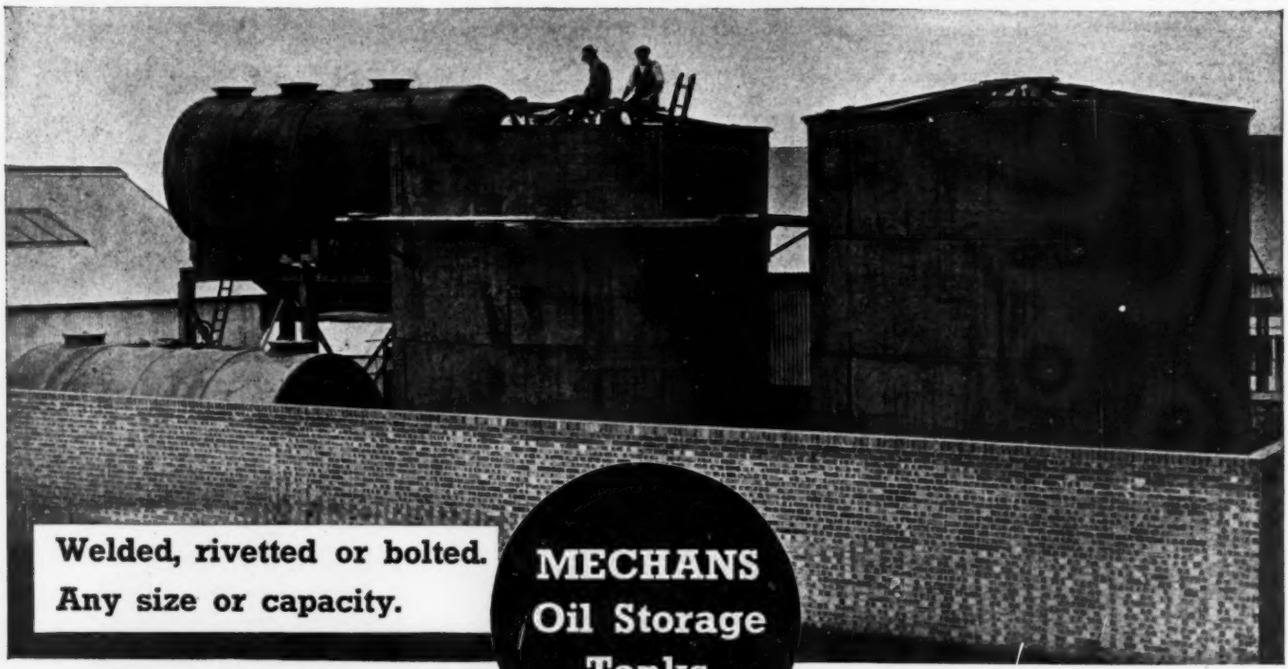
CMDR. R. C. McKee has rejoined Standard Oil Company (Indiana) as assistant advertising manager after four and one-half years of service in the navy. He joined Standard of Indiana in 1934 as editor of its monthly publication for dealers and as creative assistant to the advertising manager. He was promoted to assistant advertising manager in 1937.

Among his various assigments during the war Cmdr. McKee served as executive officer of the training division which supervised photographic history of naval aviation and produced the motion picture, "The Fighting Lady".

C. N. SWANSON has been appointed director of purchases, of the Continental Supply Company, succeding R. L. Middleton who recently resigned. He will move from Tulsa where he has been district manager, to the company's general offices in Dallas.

R. A. Brewer has been named district manager of the Kansas-Oklahoma district. He has been district manager in Fort Worth since 1939. T. D. Collins succeeds to management of the North and West Texas - New Mexico district. He comes to Fort Worth from Caspar, Wyo., where he has been district manager. He will be succeeded by J. R. Chapman, how assistant district manager at Oklahoma City.

ILLUSTRATION SHOWS TANKS DURING ERECTION AT OIL SERVICE STATION



Welded, rivetted or bolted.
Any size or capacity.

MECHANS Oil Storage Tanks

MECHANS LIMITED

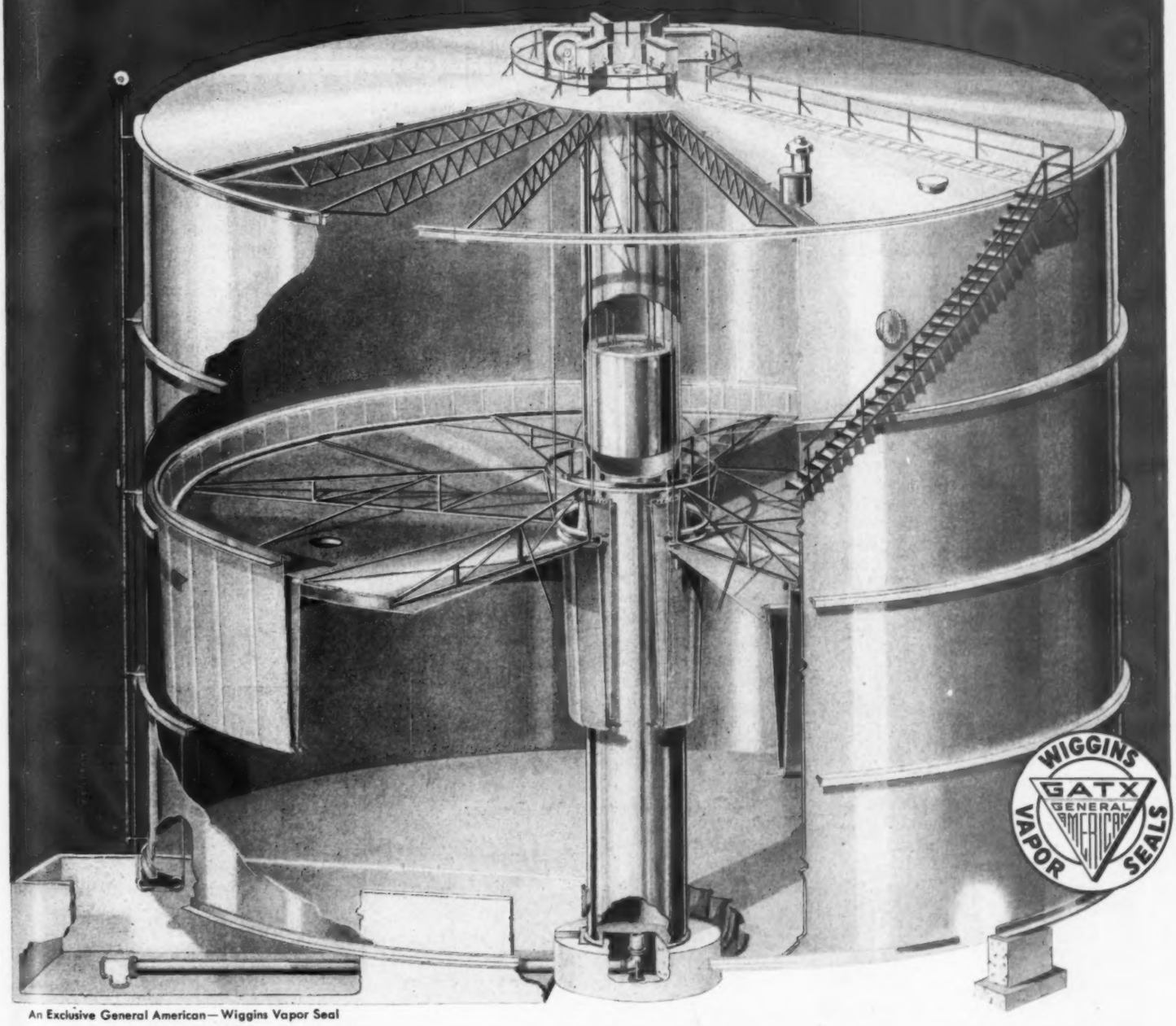
TELEGRAMS: "NAUTICAL, GLASGOW" TELEPHONE: SCOTSTOUN 2211 (SIX LINES)

SCOTSTOUN IRON WORKS, GLASGOW, W.4, SCOTLAND

TELEGRAMS: "ELONGATION, LONDON" LONDON: 10, PRINCES STREET, WESTMINSTER, S.W.1. TELEPHONE: WHITEHALL 4288

Any Gas! Any Quantity! Any Climate!

THE WIGGINS DRY-SEAL GASHOLDER



An Exclusive General American—Wiggins Vapor Seal

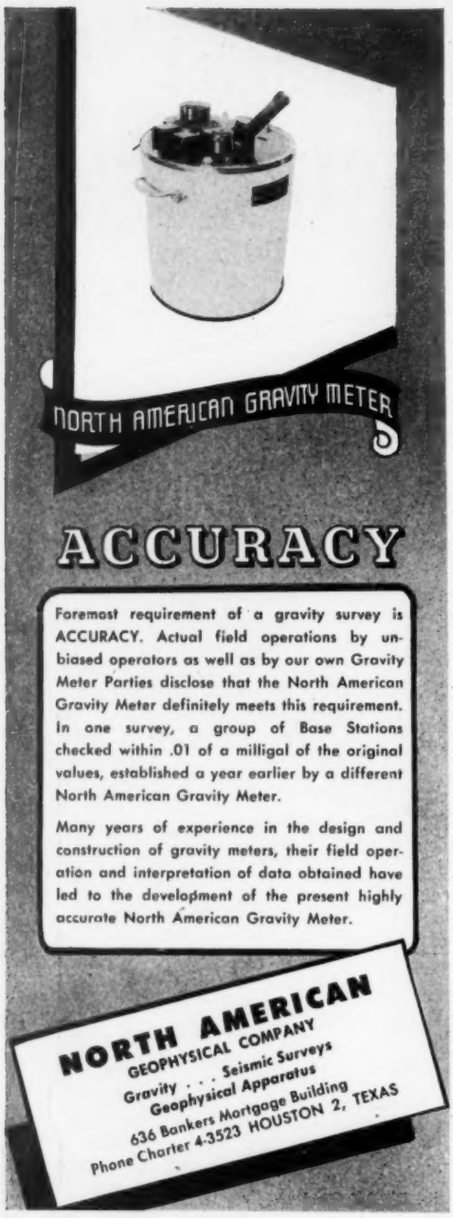
1. Can be added to any group of cone roof tanks without disturbing your present operation.
2. Operates at *practically no pressure*, with all parts available for inspection at all times when the gasholder is in operation.
3. An absolutely dry gasholder.
4. Weather has no effect on the operation.
5. Only small installation room is required.
6. Consistently low cost performance.

Successful and profitable installations of the Wiggins Dry-Seal Gasholder have been in service over ten years. The skill developed in over fifty years of experience by one of the largest and best equipped tank fabrication plants in the world is back of the manufacture and erection of every General American—Wiggins Vapor Seal. For more complete information on the Wiggins Dry-Seal Gasholder, write or contact General American Transportation Corporation, 135 S. LaSalle Street, Chicago.

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street, Chicago

With branch offices in: New York, Washington, Cleveland, Buffalo, Pittsburgh, St. Louis, New Orleans, Tulsa, Dallas, Houston, Seattle, Los Angeles.


NORTH AMERICAN GRAVITY METER
ACCURACY
Foremost requirement of a gravity survey is ACCURACY. Actual field operations by unbiased operators as well as by our own Gravity Meter Parties disclose that the North American Gravity Meter definitely meets this requirement. In one survey, a group of Base Stations checked within .01 of a milligal of the original values, established a year earlier by a different North American Gravity Meter.
Many years of experience in the design and construction of gravity meters, their field operation and interpretation of data obtained have led to the development of the present highly accurate North American Gravity Meter.
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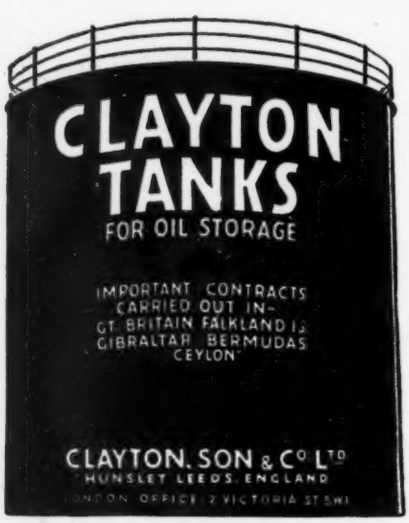

Organizes Petroleum Division

BROWN AND ROOT, INC., has organized a petroleum and chemical division under the management of Milton H. Roths who recently returned from war service in the navy. The new division will specialize in design and construction of oil, gas and chemical plants. Offices and fabrication shops will be at the Greens Bayou, Texas, plant of Brown Shipbuilding Co., Inc.

Before the war Mr. Roths was with C. F. Braun & Co., Jackson Engineering Co. and Fluor Corp., Ltd., with whom he had 16 years engineering experience. F. W. Bell, formerly with Shell and Fluor, will be process engineer. Howard M. Anderson, formerly assistant chief engineer for Fluor, is to be engineer for the new division.

Elected Franks Vice President

W. B. WOODY, for nine years chief engineer of Franks Mfg. Corp., Tulsa, has been elected vice-president in charge of engineering. In his nine years with Franks, Woody has had a hand in a number of the outstanding developments in oil field equipment. Among the first was the complete rotary drilling unit mounted on a truck. Another was the first Franks skid drilling rig designed with a derrick. Later the idea was extended to well-servicing equipment including telescoping servicing derricks.

Brazilian Representative Received Westinghouse Award

CARL E. DREHER, regional director of Brazil for the Westinghouse Electric International Co., has been awarded the Order of Merit, highest company award, for distinguished service in the foreign field. Mr. Dreher has been a member of the International Company for 20 years. His Brazilian appointment began in 1938.

Aurora Installs Cat Cracker

AURORA GASOLINE CO., Detroit, has signed a license agreement with Universal Oil Products Co. for the installation of a UOP fluid catalytic cracking unit, with design charge of 4,000 barrels a day. Aurora will be the first company to install the improved design UOP fluid catalytic cracking unit for small refineries.

New Petroleum Register

THE Petroleum Register has been the standard reference work on oil companies throughout the world for more than a quarter of a century. After a lapse of a year because of a war-time paper shortges the new 1945-46 issue now is ready for delivery. The new edition contains 600 pages divided into 19 sections. Copies are mailed postpaid anywhere in the world, $10 in the United States, $12 elsewhere. World Petroleum, 2 West 45th St., New York; Georgian House, St. James, London, S. W. 1.

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Now widely accepted by drillers as an outstanding device for surveying bore holes.

The most simple, easiest to operate and speediest inclination recorder. Operated by dry cell batteries on electro - chemical principles. Self-checking. Low in rental charge and operating cost.

Operates on measuring or wire line. Multiple recording can be made with one round trip in the hole.

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